THE VACHELL COLLECTION OF CHINESE FISHES IN CAMBRIDGE

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CONTENTS

ABSTRACT

The Rev. G. Vachell of Macao presented about a hundred Chinese fishes to the Cambridge Philosophical Society in the early part of the last century. In his *Report on the Ichthyology of the Seas of China and Japan*, Richardson based 22 new species on Vachell material. Although 80 species are listed here, the greater part of the Vachell collection is no longer extant and only 15 specimens survive ; these include the types of *Anguilla clathrata* Rich., *Pelor tigrinum* Rich., and *Seserinus vachellii* Rich.

1. INTRODUCTION

Some 18th and 19th century fish collections are well-known and their contents well documented. Others have lapsed into obscurity and provide considerable difficulties when the need arises to establish types or validate old names. One of these is the Vachell collection of Chinese fishes, the remains of which are housed in the University Museum of Zoology in Cambridge.

The Vachell collection, which appears to have contained about 80 species of fish from Macao, formed a significant part of the material on which Sir John Richardson based his " Report on the Ichthyology of the Seas of China and Japan " published in 1846. As often happens with old collections, the Vachell material included a large proportion of types. Thus 22 of the new species described by Richardson in the " Report " were based on Vachell fishes. Unfortunately, only a fraction of the Vachell collection is now extant. But this collection is of sufficient importance for a complete list to be given, particularly in order to record those specimens which survive (including the types of 3 Richardson species) those which are missing (including 7 types), and those specimens which are now known with certainty to have been destroyed (including 12 types).

The principal author, P.J.P.W., is responsible for all the systematic zoology, and K.A.J. undertook the investigation of the records in Cambridge.

2. RICHARDSON'S "REPORT"

Richardson (1846) listed 665 species of fishes from the seas of China and Japan, an enormous increase on any previous list ; 142 of these were described as new species or varieties. Over three hundred of the species listed were represented by an original

coloured drawing from a collection of illustrations of fishes from Macao and Canton compiled by John Reeves (1774–1856), an Inspector of Tea for the East India Company at Canton ; 83 new species introduced by Richardson were based solely on a Reeves illustration. Three sets of these illustrations are now in the Zoology Library of the British Museum (Natural History).

Since half (40 out of 80) of the species listed here (including 11 of the types) are illustrated by a Reeves drawing, the Reeves illustration number is cited in the synonymies. This may assist in identifying some of the missing Vachell specimens. The illustrations of the types are reproduced here, apparently for the first time (except *Chatoessus maculatus*—see Whitehead, 1966).

John Reeves, and his son J. R. Reeves, also sent a collection of fishes from Macao and Canton to the British Museum. These were examined by Richardson and Günther, and since they came from the same area as the Vachell fishes, reference is made to them in the text.

Richardson evidently examined the Vachell collection in the years up to 1845. Four of the species listed here (*Balistes vachellii*, *Anguilla clathrata*, *Aploactis breviceps*, and *Congrus lepturus*) had already been described as new by Richardson in the " Zoology of the Voyage of H.M.S. Sulphur " published in three parts between 1844 and 1845 (see " Report " p. 316 for dating). In general, however, Richardson left description of the Vachell material until the " Report ".

3. THE VACHELL COLLECTION

According to Richardson's " Report " (1846, p. 189), the Rev. George Vachell was Chaplain to the India Company at Macao in about 1830. He made a collection of about a hundred fishes from that region, and these were presented to the Philosophical Institution in Cambridge, preserved in spirits, and mostly in good condition. Nonetheless, Richardson himself described at least one fish as " not in very good condition " (p. 204), another that " the colours have suffered from long maceration in spirits " (p. 208), and another that " it is flaccid and may have lost its exact shape " (p. 267).

In 1865 the collections of the Cambridge Philosophical Society were transferred to the University of Cambridge and housed in the newly built Museum of Comparative Anatomy and Zoology. Indeed, the Philosophical Society Collection formed the nucleus of the Museum of Zoology, and although under the same roof as the Museum of Comparative Anatomy, the two collections were kept in separate rooms and remained distinct for several years. In 1867 J. W. Clark, who was Superintendant of the Museums, reported that, " Two presses have been provided to contain the collections of Fishes presented by the Philosophical Society. These consist of the following : the series of Fishes of Madeira, collected by Mr. Lowe, many of which are unique, and nearly all the types of his descriptions in the transactions of the Cambridge Philosophical Society : a considerable number of specimens procured by Mr. Darwin during the voyage of the ' Beagle ', also the types of the descriptions published by the late Sir John Richardson : a collection sent from China by Mr. Vachell ; and a collection of Fishes of Great Britain formed by the late Professor Henslow and Mr. L. Jenyns. These will at no distant period be named and catalogued by Dr. Günther, of the British Museum, who has most generously offered to undertake

this work ". (It should be noted that the punctuation of this passage suggests that Clark did not realize that the Richardson types were included within the Vachell collection.)

The following year Clark (1868) reported that during 1866–67 " Dr. Günther, of the British Museum, one of the first ichthyologists in Europe, has been so kind as to examine the collections of Fish in spirits, and to determine those that were unnamed." The major part of Günther's " Catalogue " had by then been published, but Günther makes only rare reference to specimens in Cambridge in the subsequent volumes (7 and 8), and no mention at all of having seen Vachell fishes. It is probably for this reason that the Vachell collection has been generally ignored.

A few years later, Clark (1871) again referred to the identification of the spirit collection of Fish, Amphibia and Reptiles and reported that, " I had hoped to have announced the completion of an arrangement by which the services of Dr. A. Günther, of the British Museum, the best living authority on the subject, might have been secured for this work ; but though the proposal made by the Museums' Syndicate to the Trustees of the British Museum was a most liberal one, that body did not think proper to accede to it. It will therefore be necessary to select some other competent person ". Apparently this statement had the desired effect and only a year later Clark (1872) reported that these collections had been examined and determined by Dr. Günther! It is clear that in both 1866–67 and 1870–71, Günther worked on the fish collections in Cambridge. Shipley (1913) even claims (p. 265) that the fishes were catalogued by Dr. Günther, but we have been unable to trace any other record of such a catalogue, either in London or in Cambridge.

In 1893, S. F. Harmer catalogued the entire fish collection at Cambridge, indexing the species according to the volume and page numbers of Günther's " Catalogue". The names used by Harmer are generally identical to those of Günther, but in the case of the Vachell specimens the names often differ from those given in Richardson's " Report ". This suggests that Günther re-identified and relabelled many of the Vachell specimens, despite the fact that he did not refer to them in the " Catalogue ".

Altogether, 80 species (plus 3 names here considered synonyms) are listed as appearing either in Richardson's " Report " or in Harmer's catalogue, and often in both. The vast majority are now either missing or known to have been destroyed.

A total of 32 species which were listed by Richardson as including Vachell specimens are not so listed by Harmer (including the types of 10 Richardson species). These specimens may have been lost, exchanged or destroyed without record either in the Cambridge Philosophical Institute between 1845 and 1865, or in the Museum of Comparative Anatomy and Zoology between 1865 and 1893. It is possible that Richardson worked on some of the Vachell material at the British Museum, that it was never returned to the Philosophical Institution, and that it became incorporated into the British Museum collections without ever being registered. There are in fact a number of unregistered bottles, including some labelled as presented (or collected) by Richardson. In some cases these involve Vachell species which were never included in Harmer's Catalogue of Cambridge material, and each of these have been carefully checked. Unfortunately in no case is there supplementary evidence which would prove the case either way.

It is also known that J. W. Clark spent a good deal of the summer of 1866 overhauling the Physiological Series, which had just been moved into the newly built Museum in Cambridge, and it is recorded that useless and decayed specimens were thrown away (Clark, 1867 ; Shipley, 1913). Although this activity does not refer explicitly to the fish collection it does give a clear indication of the policy that was being implemented in the Museum during the same period that Günther was working on the fish, and this might account for some of the 32 species which were missing before Harmer's 1893 catalogue.

The possibility that some of the Vachell material was acquired by the British Museum between 1865 and 1893 has also been checked. Such an acquisition seems most likely to have occurred during or after Günther's visit in 1866–67, or as a part of the arrangement made in 1870–71, the terms of which are not known. But the British Museum registers from 1866–93 show no gifts, purchases or exchanges involving the Cambridge Museum. It is certain that no Vachell material went to London officially, and in some doubtful cases the British Museum material has been checked and no evidence found that any arrived unofficially.

Conversely, there are 16 species listed by Harmer as being Vachell material which are not so mentioned by Richardson. Either Richardson missed these, or perhaps they were not true Vachell specimens but were erroneously included by Harmer. Among these, one Cambridge specimen of *Boleophthalmus campylostomus* (see p. 147) was transferred to the British Museum in 1917, but although Harmer lists it as a Vachell fish, Richardson (Report, p. 209) states that he had seen no specimens.

Harmer's 1893 catalogue is in two parts, one listing the stored material and the other listing those specimens which were on exhibition at that time, the latter being given separate registration numbers. A large number of Harmer's entries in the catalogue of stored material have since been crossed out, and these specimens are no longer extant. A note in the front of the catalogue states : " The collection of fishes in store was overhauled during May, 1939, when specimens thought to be of little or no value were discarded." We understand from the present Director, Dr. F. R. Parrington, that this clearance included many dried-up, rotten and disintegrated specimens, and he recalls that his predecessor, Sir Clive Forster-Cooper, once recounted that some of the fishes which had matured beyond repair were found to have been pickled in rum! It seems certain that those specimens which are crossed off Harmer's catalogue were destroyed, in contrast to those which are just missing insofar as they do not appear in Harmer's list.

It is right and proper to ask why so little of the Vachell collection survives today, despite the fact that it was presented to an Institution which could well have been expected to provide security. Only by such enquiry can it be hoped to avoid similar disappointments in the future. In this case, there seems to have been a combination of circumstances. Richardson provides some evidence of poor fixation and preservation, which continued to take its toll more than a century later. Clark apparently did not appreciate that the Vachell collection included the Richardson types, and for some inexplicable reason Günther drew no attention to them. Hence, in the majority of cases, Harmer was unaware of the type specimens, and did not indicate them as such when he prepared his catalogue. In consequence, when the collection

was overhauled nearly 50 years later, many types were discarded.

Until relatively recently it has been accepted practice in most museums that material which had suffered beyond repair was destroyed and crossed off the catalogue, unless, of course, it was recorded as type material. In retrospect this policy is to be regretted in the present case, and this has caused us to give some thought to the problem. For one reason or another, whether it be faulty fixation, poor storage conditions, sheer neglect or genuine accident, nearly all Museums possess some important material that has suffered, apparently beyond repair. We now hold the view that those responsible for such collections must accept this as almost inevitable, and without shame should retain such material, rather than totally destroying it. Advances in technology are now providing new methods of obtaining information from such material, and although apparently useless to one generation, it may be capable of yielding information to the next. Methods now exist for reconstituting dried up specimens, and for " developing " labels which have become illegible in ordinary light. In the present instance, X-ray photography of even the rotten material might have yielded sufficient information about the skeleton to establish the identity of the species, but unfortunately none of these techniques can now be applied, because most of the material has been destroyed.

4. SYSTEMATIC LIST

In the following list of Vachell species, the synonyms of Richardson and Günther have been given, headed by the modern name for the species. The latter have posed considerable difficulties, particularly when no specimens survive and where the identification must be made on a brief description by Richardson, sometimes supplemented by a Reeves illustration. Richardson's specimens were evidently not always consistent with the Reeves drawing (e.g. in the case of *Sebastodes vachellii* —p. 140), a fact not always appreciated by later authors. In many cases, therefore, it has been possible to do no more than to follow the comprehensive synonymies of Chu (1931), Herre (1953), Chu, Tchang & Chen (1964) and Fowler (*Synopsis of fishes of China*, from 1930 onwards) ; only Chu and Fowler have listed all or almost all Richardson names. Sometimes, a recent study of a particular group has helped to identify the Vachell material, but even then the Vachell specimens themselves do not appear to have been examined, perhaps since the time of Günther's visits to Cambridge nearly a century ago. In addition, very few authors seem to have examined the Reeves illustrations.

We have listed here fifteen specimens representing eleven species which appear to be part of the original Vachell collection. Even these numbers are by no means certain since several are listed only by Harmer and not by Richardson as being Vachell material. Notes on these extant specimens and their identifications are given separately in Section 5 (p. 147).

Those of Richardson's species which were based wholly or partly on Vachell material are marked with an asterisk and are listed separately in Table I.

We are particularly grateful to Mr. W. L. Chan, of the Fisheries Research Station in Hong Kong, for his help in identifying the fishes shown in the Reeves illustrations reproduced here and his comments on the Chinese names applied to these fishes.

Class *CHONDRICHTHYES*

Family **ORECTOLOBIDAE**

1. ***Chiloscyllium plagiosum*** (Bennett)

Chiloscyllium plagiosum: Richardson, 1846: 194 (Vachell material) (Reeves illustr. No. 252).
Chiloscyllium indicum: Günther, 1870, **8** : 413 (material listed under six varieties).

As *Chiloscyllium indicum* " (several) China Rev. G. Vachell " in Harmer's list—destroyed, 1912 according to catalogue. A half-grown Richardson specimen and a Reeves juvenile in British Museum. Günther does not mention any specimens in Cambridge, although he had inspected the Vachell material by this time. The identification of the three sharks listed here is based on the review of Taiwan species by Chen (1963).

Family **CARCHARHINIDAE**

2. ***Carcharhinus melanopterus*** Quoy & Gaim.

Carcharias (*Prionodon*) *melanopterus:* Richardson 1846: 194 (not stated as Vachell specimen) (Reeves illustr. No. 23).
Carcharias melanopterus: Günther, 1870, **8** : 369 (South Africa and Amboyna material only).

As *Carcharias* (*Prionodon*) *melanopterus*, juvenile " China, Rev. G. Vachell " in Harmer's list—destroyed. No Cambridge material mentioned by Günther.

Family **TRIAKIDAE**

3. ***Triakis scyllia*** Müller & Henle

Triakis scyllium: Richardson, 1846: 195 (no specimens).
Triacis scyllium: Günther, 1870, **8** : 384 (no specimens).

As *Triacis ? scyllium*, juvenile, " China Rev. G. Vachell " in Harmer's list—destroyed. Vachell specimen presumably overlooked by Richardson, if indeed it did belong to the Vachell collection. Again, Günther makes no mention of Cambridge material.

Class *OSTEICHTHYES*

Family **CLUPEIDAE**

4. ***Clupanodon thrissa*** (Linnaeus)

**Chatoessus maculatus* Richardson, 1846: 308 (a single Vachell specimen, TYPE) (Reeves illustr. No. 109).
Chatoessus maculatus: Günther, 1868, **7** : 409 (Formosa specimens only).

Harmer lists " *Clupea thrissa.* (several). No histy.", but these were subsequently destroyed. Since *Chatoessus maculatus* was the only clupeid represented in the Vachell collection, it is possible that one of the Harmer specimens was the type. Günther mentions only three Formosan specimens but not the Vachell material in Cambridge. For identification of *C. maculatus*, see Whitehead (1966). Reeves illustration reproduced here (Plate 1, fig. 1).

Family **ENGRAULIDAE**

5. ***Coilia playfairii*** (McClelland)

Coilia playfairii: Richardson, 1846 : 309 (see note below).
Coilia clupeoides: Günther, 1868, **7** : 404 (" Chinese Seas ", no mention of Cambridge material).

Listed as *Coilia* (*mystus*), with the name *clupeoides* written above, " ' Fishes from China ' Canton ", not in Harmer's hand—EXTANT. A single specimen now exists, but with only a modern label indicating that it is a Canton fish. However, Richardson states " specimens exist in all the collections of Chinese fishes that we have seen ". Günther does not mention having seen any Cambridge material. Measurements and notes on the extant specimen are given in Section 5 (p. 149), and further notes on Richardson material are given by Whitehead (1966).

Family **SALANGIDAE**

6. ***Salanx chinensis*** (Osbeck)

Leucosoma chinensis: Richardson, 1846 : 303 (Reeves and Vachell specimens).
Salanx chinensis: Günther, 1866, **6** : 205 (China, including type of *Leucosoma reevesii* Gray).

Listed by Harmer as " *Salanx chinensis* (2) ?History "—destroyed. The British Museum has a specimen from the Haslar collection, as well as the type of *Leucosoma reevesii*. Identification based on Chu (1931).

Family **ANGUILLIDAE**

7. ***Anguilla japonica*** (Temminck & Schlegel)

**Anguilla clathrata* Richardson, 1844 : 104 (one Vachell specimen, TYPE) ; *Idem*, 1846 : 312.
Anguilla clathrata: Günther, 1870, **8** : 23 (doubtful species No. 4, name only).

A single specimen listed by Harmer as *A. vulgaris* " China. Rev. G. Vachell."—EXTANT. This specimen was subsequently transferred as F.2002 to the Exhibited series. Günther had already examined the Vachell collection but did not acknowledge having seen this fish. Richardson's description (*Zoology of the Sulphur*, p. 104) was based on a Vachell fish of 8·8 inches from Canton. See Section 5 for description and notes on this HOLOTYPE.

Family **MURAENESOCIDAE**

8. ***Muraenesox cinereus*** (Forsskål)

Congrus tricuspidatus: Richardson, 1846 : 312 (Vachell specimens).
Muraenesox cinereus: Günther, 1870, **8** : 46 (Reeves specimens and type of *C. tricuspidatus*).

Listed as *M. cinereus* " China Rev. G. Vachell " by Harmer—destroyed. Cambridge material not mentioned by Günther. Identification based on Chu, Tchang & Chen (1963).

Family **CONGRIDAE**

9. ***Uroconger lepturus*** (Richardson)

Congrus lepturus Richardson, 1844 : 106, and 1846 : 132 (Canton, but no reference to Vachell specimens).
Uroconger lepturus: Günther, 1870, **8** : 44 (Reeves specimens, the TYPE, and another Chinese specimen).

Listed as *Uroconger lepturus*, 2 specimens " China Rev. G. Vachell " by Harmer—destroyed. Günther does not refer to Cambridge material. The species was described by Richardson (*Zoology of the Sulphur*, p. 106, Pl. 56, figs. 1–6) with a single set of measurements relating to a specimen of 9 inches from Canton, but no indication of the collector (presumably Reeves). There is a specimen of 160 mm. S.L. (10¼ inches) labelled as type in the British Museum (unregistered but with a metal tag " 821 ") ; the second Chinese specimen is even larger (322 mm.). The first is labelled "Reeves " and the second was purchased from a Mr. Warwick. Present identification based on Chu, Tchang & Chen (1963).

Family **OPHICHTHIDAE**

10. ***Pisodonophis boro*** (Ham. Buch.)

Ophisurus harancha: Richardson, 1846 : 313 (one fish of 14½ inches in Camb. Phil. Inst., a Reeves specimen and an Indian specimen).
Ophichthys pallens: Günther, 1870, **8** : 61 (the Reeves type only).

Harmer listed 2 specimens of *Ophichthys cancrivorus* " China Rev. G. Vachell "—destroyed. Although Richardson (1846) believed the Vachell, Reeves, and Indian specimens to be conspecific, he elsewhere (*Erebus & Terror*, p. 10) proposed the name *pallens* for the Reeves fish, while still claiming the Vachell specimen to be true *harancha*. Günther (1868, p. 61) considered Richardson's *harancha* to be *pallens*, as also did Chu (1931). Fowler (1932*a*, p. 126) agreed, but placed both under an earlier Hamilton-Buchanan name, *Pisodonophis boro*, and this course has been adopted here.

Family **BAGRIDAE**

11. ***Pseudobagrus vachellii*** (Richardson)

**Bagrus vachellii* Richardson, 1846 : 284 (one Vachell specimen of 5 inches, the TYPE).
Pseudobagrus vachellii: Günther, 1864, **5** : 85 (Chinese specimens).

Listed as *P. aurantiacus* " China. Rev. G. Vachell " in Harmer's catalogue—destroyed. Günther had kept the closely related *P. vachellii* and *P. aurantiacus* separate, but he may have reconsidered this when he came to identify the Cambridge material. Since Harmer listed two Vachell *Pseudobagrus* species, and Richardson two Vachell *Bagrus* species, it must be assumed that the two species correspond. Present identifications follow Chu (1931).

12. *Pelteobagrus fulvidraco* (Richardson)

**Bagrus limbatus* Richardson, 1846 : 283 (one Vachell specimen, the TYPE).
Pseudobagrus fulvi-draco: Günther, 1864, **5** : 85 (one Chinese fish presented by Günther himself).

Listed as *Pseudobagrus fulvi-draco* " China. Rev. G. Vachell " by Harmer—destroyed. Fowler (1932*b*) identified Richardson's species as *Plotosus anguillaris* (Bloch), but curiously did not list Richardson's *B. vachellii*.

Family **PLOTOSIDAE**

13. *Plotosus anguillaris* (Bloch)

Plotosus lineatus: Richardson, 1846 : 286 (specimens in the Camb. Phil. Inst.) (Reeves illustr. No. β11).
Plotosus anguillaris: Günther, 1864, **5** : 24 (Chinese specimens).

Listed as *Plotosus anguillaris* " (several) ?history " in Harmer's Catalogue—destroyed. Possibly the Cambridge Philosophical Institution had other Chinese material in addition to the Vachell specimens. Present identification based on Chu (1931) and Fowler (1932*b*).

Family **BELONIDAE**

14. *Strongylura strongylura* (van Hasselt)

Belone caudimaculata: Richardson, 1846 : 264 (no Vachell material) (Reeves illustr. No. β33).
Belone caudimaculata: Günther, 1866, **6** : 245 (no China specimens).

Listed as *B. strongylurus*, " ? China " by Harmer—destroyed. Richardson gave no description but mentioned specimens from Canton (Reeves) and from Port Essington. Günther (1866) placed the former in *B. strongylurus* and the latter in *B. caudimaculata*. Present identification based on Fowler (1932*b*).

Family **SOLEIDAE**

15. *Microbuglossus ovatus* (Richardson)

**Solea ovata* Richardson, 1846 : 279 (a single Vachell specimen, 3½ inches, the TYPE) (no Reeves illustr.).
Solea ovata: Günther, 1862, **4** : 472 (Chinese specimens).

Listed by Harmer under *Solea ovata*, 4 specimens " China Rev. G. Vachell "—destroyed. Günther (1862) lists an Amoy and a Haslar Collection specimen, and 4 fishes presented by Belcher. The latter are labelled as types, but they are too small and Richardson mentions only Vachell material. The single Haslar fish, however, may well have been 3½ inches in length (caudal now damaged) but there are 59 dorsal rays (65 described). Identification based on Chu, Tchang & Chen (1963).

16. *Zebrias zebra* (Bloch)

**Solea ommatura* Richardson, 1846 : 279 (two Vachell specimens, the TYPES) (Reeves illustr. No. *β*13).
Synaptura zebra: Günther, 1862, **4** : 484 (Chinese specimens).

Listed by Harmer, as *Synaptura zebra*, four fishes, " No histy."—destroyed. No British Museum material which could be the lost Vachell types. Reeves illustration reproduced here (Plate 1, fig. 4). Identification follows Chu, Tchang & Chen (1963).

Family **CYNOGLOSSIDAE**

17. *Cynoglossus grammicus* (Richardson)

**Plagiusa grammica* Richardson, 1846 : 280 (two Vachell specimens 3¾ inches, the TYPES) (no Reeves illustr.).
Plagiusa grammica: Günther, 1862, **4** : 492 (doubtful species No. 5, name and reference to the " typical specimen " in Camb. Phil. Soc. collection).

Listed as *Cynoglossus trigrammus* " (several). China. Rev. G. Vachell " by Harmer (presumably having been re-identified by Günther)—destroyed. No evidence of Vachell material in British Museum. Richardson's species is ignored by Chu, Tchang & Chen (1963), and the present identification follows Fowler (1934).

Family **HOLOCENTRIDAE**

18. *Holocentrus ruber* (Forsskål)

Holocentrum albo-rubrum: Richardson, 1846 : 223 (Vachell specimens) (Reeves illustr. *α*19.)
Holocentrum rubrum: Günther, 1859, **1** : 35 (Reeves and other Chinese material).

Two specimens are given in Harmer's list as *Holocentrum rubrum*, " China. Rev. G. Vachell."—EXTANT. There are also two dry specimens listed by Harmer but stated to have " no history ". These are also extant and were presumably identified by Günther. See Section 5 (p. 151) for notes on the two extant spirit specimens.

Family **CHANNIDAE**

19. *Channa maculata* (Lacepède)

Ophicephalus maculatus: Richardson, 1846 : 251 (two Vachell specimens) (Reeves illustr. Nos. 148 and *β*19).
Ophiocephalus maculatus: Günther, 1861, **3** : 480 (Reeves and China specimens).

Listed as *O. argus* in Harmer's list, 2 + 1 specimens, " China. Rev. G. Vachell "—destroyed. Günther considered *O. maculatus* to be close to *O. argus*, but seems to have re-identified the Cambridge material as the latter. Present identification based on Chu (1931).

Family **ATHERINIDAE**

20. ***Atherina bleekeri*** (Günther)

Atherina bleekeri Günther, 1861, **3** : 398 (Reeves specimens).

Listed as *A. bleekeri* " China. Rev. G. Vachell " by Harmer—destroyed. No species of *Atherina* are listed by Richardson, so Harmer's specimens were either overlooked or were not in fact Vachell fishes.

Family **MUGILIDAE**

21. ***Mugil cephalus*** (Linnaeus)

Mugil japonicus: Richardson, 1846 : 247 (no Vachell material).
Mugil cephalus: Günther, 1861, **3** : 419 (Reeves and Chinese specimens).

Listed as *M. cephalotus* by Harmer, 2 specimens " China. Rev. G. Vachell "—destroyed. Richardson included seven species of *Mugil* in the " Report ", none based on Vachell specimens. Richardson's *M. macrolepidotus* is another synonym of *M. cephalus*, according to Fowler (1935), who has been followed here.

Family **SPHYRAENIDAE**

22. ***Sphyraena obtusata*** (Cuvier)

Sphyraena chinensis: Richardson, 1846 : 266 (one Vachell specimen) (Reeves illustr. No. 62).
Sphyraena chinensis: Günther, 1860, **2** : 334 (doubtful species No. 1).

Not listed by Harmer. No British Museum specimens labelled *S. chinensis*. Present identification follows Chu (1931).

Family **TRICHIURIDAE**

23. ***Lepturacanthus savala*** (Cuvier)

Trichiurus intermedius: Richardson, 1846 : 268 (one British Museum specimen, but no Vachell material) (Reeves illustr. No. β56).
Trichiurus savala: Günther, 1860, **2** : 347 (East Indian and Chinese specimens).

One specimen listed by Harmer, as *T. muticus* " China. Rev. G. Vachell ", now transferred to Exhibited Series No. F.2685—EXTANT. Richardson placed *T. muticus* Gray in his synonymy of " *T. lepturus, japonicus* " (" Report ", p. 268), a record which he based solely on *T. lepturus* Temm. & Schl. from Japan. He included *Trichiurus savala* Cuvier in his synonymy of *T. armatus* Gray, but did not list any material at Cambridge. The present specimen may have been one that he overlooked. See Section 5 (p. 152) for discussion of this specimen.

Family **NOMEIDAE**

24. ***Psenopsis anomala*** (Temm. & Schl.)

**Trachinotus melo* Richardson, 1846 : 270 (one Vachell specimen, the TYPE) (Reeves illustr. No. 97).
Trachinotus melo: Günther, 1860, **2** : 485 (on Richardson's description, no specimens).

Not included in Harmer's list, presumed lost before 1893. The specimen is not in the British Museum collections. Reeves illustration reproduced here (Plate 1, fig. 3). Identification follows Chu (1931) and Fowler (1936).

Family **FORMIONIDAE**

25. ***Parastromateus niger*** (Bloch)

**Seserinus vachellii* Richardson, 1846 : 273 (two Vachell specimens, the larger 3·75 inches, the TYPES).
Stromateus niger: Günther, 1860, **2** : 401 (one Reeves specimen).

Harmer lists two specimens under the name *Platax teira* " China. Rev. G. Vachell." —EXTANT. These specimens have been identified as the types of *Seserinus vachellii*. See Section 5 (p. 153) for description and notes.

Family **CARANGIDAE**

26. ***Alectis indica*** (Rüppell)

Gallichthys major: Richardson, 1846 : 271 (one Vachell specimen) (Reeves illustr. No. 189).
Caranx gallus: Günther, 1860, **2** : 455 (one Reeves specimen and one other Chinese specimen).

As *Caranx gallus* in Harmer's catalogue, two fishes " China. Rev. G. Vachell "—destroyed. Identification follows Fowler (1936, p. 297), who used Cuvier's generic name *Scyris*.

27. ? ***Alectis ciliaris*** (Bloch)

Blepharis fasciatus: Richardson, 1846 : 271 (one Vachell specimen) (Reeves illustr. No. 269).
Blepharis fasciatus (*non* Rüpp.): Günther, 1860, **2** : 422 (doubtful species No. 19, typical specimen in Camb. Phil. Inst.).

Not listed by Harmer, presumed lost before 1893. Richardson identified his specimen with *B. fasciatus* Rüppell, a synonym of *A. ciliaris* (Bloch), but Günther disagreed (1860, p. 454), presumably on Richardson's description. Not in British Museum collections. Tentative identification of Fowler (1936, p. 295) followed here.

28. ***Caranx* (*Atule*) *kalla*** (Cuvier)

**Caranx cancroides* Richardson, 1846 : 274 (one Vachell specimen, the TYPE) (Reeves illustr. No. β30).
Caranx cancroides: Günther, 1860, **2** : 422 (doubtful species No. 12).

Not mentioned in Harmer's list, presumed lost or destroyed before 1893. Reeves

illustration reproduced here (Plate 1, fig. 2). W. L. Chan (*in litt.*) states that in Hong Kong the vernacular name *Ha-tsee* on the Reeves illustration (*Hwa tsze* in the " Report ") refers (prefix) to shrimp, and (suffix) to " a carangid fish either typically of the genus *Decapterus*, or of the subgenus *Atule* Jordan." *Decapterus* can be ruled out as being too slender (depth about 5 or more times in total length ; about 3 in Richardson's description and in the drawing). *Caranx* (*Atule*) *kalla* Cuv. is the most likely species and one that is caught in fair numbers by the Hong Kong shrimp trawlers. Richardson states " No spots are shown on the operculum " (present in *C. kalla*), but the figure shows a fish of only $4\frac{1}{2}$ inches.

29. ***Caranx malabaricus*** (Bloch & Schneider)

Caranx malabaricus: Richardson, 1846 : 275 (two Vachell specimens) (Reeves illustr. No. *β*21).
Caranx malabaricus: Günther, 1860, **2** : 436 (one Reeves and one other Chinese specimen ; BMNH. 1851.12.27.118).

Not listed by Harmer, presumed destroyed or lost before 1893. An unregistered specimen merely labelled " *Caranx malabaricus* " in British Museum collection, but no indication of donor. Identification based on Fowler (1936, p. 293), who placed the species in *Carangoides*.

30. ***Citula armata*** (Forsskål)

Caranx ciliaris: Richardson, 1846 : 276 (" spec. C. Ph. Inst.").
Caranx armatus: Günther, 1860, **2** : 453 (one Chinese specimen, BMNH. 1851.12.27.129, no donor given).

Listed by Harmer as *Caranx armatus* " China. Cambridge Philosoph. Society's Collection "—EXTANT, Exhibited Series No. F.2755. There is also an unregistered British Museum specimen with an old label " *Caranx ciliaris* " amended to " *armatus* ". The jar is unusual, being oval in cross-section and sealed with parchment ; such jars were initially suspected of being part of the Vachell collection, but the present case shows this to be incorrect. The Cambridge specimen is discussed further in Section 5 (p. 154).

Family **LEIOGNATHIDAE**

31. ***Leiognathus brevirostris*** (Valenciennes)

Equula nuchalis: Richardson, 1846 : 276 (two Vachell specimens) (Reeves illustr. Nos. G90 and *β*85).
Equula nuchalis: Günther, 1860, **2** : 500 (Reeves and other Chinese specimens).

Not included in Harmer's list. Reeves illustration No. *β* 85 is not a leiognathid, but No. G 90 is almost certainly *L. brevirostris*, having a distinct black pre-dorsal blotch, a body depth 2 1/5 times in S.L., and the lateral line not reaching the base of the caudal. Richardson gives no description.

Family **GERRIDAE**

32. ***Gerres erythrourus*** (Bloch)

Gerres equula: Richardson, 1846 : 239 (one Vachell fish) (Reeves illustr. No. 215).
Gerres oyena: Günther, 1859, **1** : 352 and 1862, **4** : 261 (no Chinese specimens).

Not included in Harmer's list. Identification follows Chu (1931).

Family **AMBASSIDAE**

33. ***Ambassis commersonii*** (Cuvier)

**Ambassis vachellii* Richardson, 1846 : 221 (one Vachell specimen, the TYPE) (no Reeves illustr.).
Ambassis vachellii: Günther, 1859, **1** : 227 (no British Museum specimens).

Listed as *Ambassis commersonii*, " ? China Rev. G. Vachell " in Harmer's catalogue, two specimens—destroyed. Fowler (1937) tentatively recognized Richardson's species because of its deep body, but without specimens or illustration the species must remain doubtful.

Family **SERRANIDAE**

34. ***Epinephelus fario*** (Thunberg)

Serranus trimaculatus: Richardson, 1846 : 232 (Vachell specimens).
Serranus trimaculatus: Günther, 1859, **1** : 109 (Reeves fish and another Chinese specimen).

As *S. trimaculatus* " China. Rev. G. Vachell " in Harmer's catalogue—destroyed, with date 21.4.1939. Identification based on Chu (1931) and Fowler (1938*a*, p. 273).

35. ***Epinephelus akaara*** (Temm. & Schl.)

**Serranus shihpan* Richardson, 1846 : 231 (Vachell specimens, also Reeves and Hyde Park collections all part of TYPE SERIES) (Reeves illustr. No. 71).
Serranus diacanthus: Günther, 1859, **1** : 110 (Chinese specimens, presented by Reeves, Richardson and the East India Co.).

Not included in Harmer's list. Günther placed Richardson's species in the synonymy of *S. diacanthus*. There are several unregistered Chinese specimens in the British Museum (including a Reeves fish) labelled *S. diacanthus*, but none labelled *S. shihpan*. Reeves illustration reproduced here (Plate 2, fig. 1).

Richardson was strongly inclined to refer this species to *E. akaara*, but decided to keep it separate because of the " dark bars which cross the body ". Matayama (1960), Chu, Tchang & Chen (1963), as well as earlier authors, have placed Richardson's species in the synonymy of *E. akaara*, but Fowler & Bean (1930) placed it in the synonymy of *E. malabaricus* (Bloch & Schn.). W. L. Chan (*in litt.*) has pointed out that the vernacular name *Sek-dang-paan* is used in Hong Kong for one of the commonest species, *E. fasciatomaculatus* (Peters), whereas *E. akaara* is known as *Hung-pan*. Also, the absence of definite spots on the dorsal fin in the Reeves figure, and the inclination of the vertical bars on the flanks and their tendency to

fork ventrally, all point to *E. fasciatomaculatus*. However, Matayama (*loc. cit.*) placed *E. fasciatomaculatus* (Peters) as a synonym of *E. fario* (Thunberg), but considered *E. fasciatomaculatus* of Fowler & Bean to have been *E. diacanthus* (Val.). Because of such uncertainties in the nomenclature we have preferred to let Richardson's species remain in the synonymy of *E. akaara* for the time being.

Family **PRIACANTHIDAE**

36. ***Priacanthus tayenus*** (Richardson)

**Priacanthus tayenus* Richardson, 1846 : 237 (one Vachell specimen and one Reeves specimen, the TYPES) (Reeves illustr. No. β14).
Priacanthus tayenus: Günther, 1859, **1** : 221 (a single specimen, collected by Reeves).

Listed as *P. japonicus* " China. Rev. G. Vachell " by Harmer—destroyed. A single Reeves specimen in British Museum (BMNH. 1965.8.12.50) labelled as type. No evidence that the Vachell specimen is present. Reeves illustration reproduced here (Plate 2, fig. 2). Identification follows Chu (1931) and Fowler (1938*b*, p. 67).

Family **PEMPHERIDAE**

37. ***Pempheris otaitensis*** (Cuvier)

Pempheris otaitensis: Günther, 1860, **2** : 508 (one Chinese specimen).

Listed by Harmer as *P. otaitensis* " China. Rev. G. Vachell "—destroyed. Richardson (p. 244) only mentions the related *P. moluca* Cuvier without reference to any specimens at all.

Family **LUTJANIDAE**

38. ***Lutjanus erythropterus*** (Bloch)

Mesoprion annularis: Richardson, 1846 : 229 (one Vachell specimen).
Mesoprion annularis: Günther, 1859, **1** : 204 (Reeves specimens).

Two specimens included in Harmer's list as *M. annularis* " ? History "—destroyed. Identification follows Chu (1931) and Fowler (1938*b*, p. 83).

Family **POMADASYIDAE**

39. ***Pomadasys argenteus*** (Forsskål)

Pristipoma nageb: Richardson, 1846 : 227 (one Vachell specimen) (Reeves illustr. No. 244).
Pristipoma hasta: Günther, 1859, **1** : 289 (Reeves and other Chinese material).

Listed as *P. hasta* " China. Rev. G. Vachell " in Harmer's catalogue—destroyed. Günther retained *P. nageb* as a separate species (1859, p. 290), but mentioned no Cambridge material and only tentatively placed Richardson's record in the synonymy. Fowler (1939*a*) considered Richardson's record to refer to *P. argenteus* (Forssk.) and the Reeves illustration is consistent with this.

Family **THERAPONIDAE**

40. ***Therapon jarbua*** (Forsskål)

Therapon servus: Richardson, 1846 : 238 (no Vachell specimens mentioned) (Reeves illustr. No. β44).
Therapon servus: Günther, 1859, **1** : 278 (Reeves and other Chinese specimens).

Listed as *T. servus* " China. Rev. G. Vachell " by Harmer, several specimens—destroyed. Richardson included three other species of *Therapon* (*T. theraps*, *T. oxyrhynchus* and *T. quadrilineatus*), none of which were represented by Vachell material. Identification based on Fowler (1939*b*, p. 204).

Family **SPARIDAE**

41. ***Chrysophrys major*** (Temminck & Schlegel)

Pagrus unicolor: Richardson, 1846 : 242 (Vachell specimen) (Reeves illustr. No. 160).
Pagrus unicolor: Günther, 1859, **1** : 468 (One Hong Kong fish presented by Richardson).

Listed as *P. major* by Harmer " [A specimen from China, Rev. G. Vachell, was lost by evaporation of spirit] " Identification based on Fowler (1940, p. 53).

42. ***Sparus latus*** (Houttuyn)

?*Chrysophrys berda:* Richardson, 1846 : 240 (no Vachell material) (Reeves illustr. No. 223).
Chrysophrys hasta: Günther, 1859, **1** : 491 (the Reeves type and other Chinese specimens).

Listed as *C. hasta*, " China (? Rev. G. Vachell) " by Harmer—destroyed. Richardson gives nine species of *Chrysophrys*, none of which included Vachell material. He placed *Sparus hasta* Bloch & Schn. in his synonymy of *C. berda*. Identification follows Chu (1931).

Family **MULLIDAE**

43a. ***Upenoides subvittatus*** (Temm. & Schl.)

Upeneus subvittatus: Richardson, 1846 : 219 (one Vachell fish, 4 inches).
Mullus subvittatus: Günther, 1859, **1** : 397 (doubtful species No. 2).

Not listed in Harmer's catalogue. Fowler (1941) listed this Richardson record under *Upeneus subvittatus*.

43b. ***Upenoides subvittatus***(Temm. & Schl.)

Upeneus russelii: Richardson, 1846 : 220 (one injured Vachell specimen) (Reeves illustr. α36).
Upeneus indicus: Günther, 1859, **1** : 406 (two Reeves stuffed specimens, no others).

Not listed by Harmer. Fowler (1941) identified Richardson's record as *Pseudupeneus indicus* (Shaw).

Family **SCIAENIDAE**

44. ***Otolithes argenteus*** (Cuvier)

Otolithus argenteus: Richardson, 1846 : 225 (one Vachell specimen, 6·55 inches).
Otolithus argenteus: Günther, 1860, **2** : 310 (Reeves and East India Co. specimens).

Not included in Harmer's list. The identifications of the three sciaenids listed here are based on the recent work by Chu, Lo & Wu (1963).

45. ***Collichthys lucidus*** (Richardson)

Sciaena lucida Richardson, 1844 : 87, and 1846 : 224 (see below).
Collichthys lucida: Günther, 1860, **2** : 312 (Reeves and other Chinese specimens).

Listed as *Collichthys lucida* " China. Rev. G. Vachell " in Harmer's catalogue—destroyed. Richardson made no direct reference to Vachell material but states " forms part of all the collections of Chinese fish that we have examined ". Richardson described the species (*Zoology of Sulphur*, p. 87) on material in the British Museum, Hasler Museum and Camb. Phil. Soc. He measured a single specimen, 6·45 inches in length. There are two British Museum fishes labelled as types (BMNH. 1848.3.18.107–8) ; the larger of the two (163 mm. tot. l., 6·4 inches) is most likely the specimen measured by Richardson. There are also two Haslar specimens (BMNH. 1855.9.19.195–7).

46. ***Dendrophysa russelii*** (Cuvier)

Umbrina russelii: Richardson, 1846 : 226 (one Vachell fish) (Reeves illustr. No. β37).
Umbrina russellii: Günther, 1860, **2** : 278 (Malaya and " China Seas? ").

Listed by Harmer as *Umbrina russellii* " ? E. Indies "—destroyed.

Family **SILLAGINIDAE**

47. ***Sillago japonica*** (Temm. & Schl.)

Sillago japonica: Richardson, 1846 : 223 (Vachell and Reeves specimens) (Reeves illustr. No. β40).
Sillago sihama: Günther, 1860, **2** : 243 (Reeves and China specimens).

Listed as *S. japonica* " China. Rev. G. Vachell " by Harmer, three specimens—destroyed. Günther (1860) referred all his Chinese material to *S. sihama* and not *S. japonica* ; presumably he changed his mind by the time he came to re-identify the Cambridge specimens. Identification based on Chu (1931).

Family **EPHIPPIDAE**

48. ***Platax orbicularis*** (Forsskål)

Platax teira: Günther, 1860, **2** : 492 (China specimens).

Harmer lists *Platax teira*, 2 specimens " China. Rev. G. Vachell." but, as shown earlier, the actual specimens are the types of *Seserinus vachellii*. Richardson (1846,

p. 245) lists *P. ehrenbergii* Cuvier and *P. vespertilis* Bloch, both of which he identified from Reeves drawings ; in neither case does he mention specimens. Although the present specimens were mislabelled, the name *Platax teira* is included in this list of possible Vachell material.

49. ***Drepane punctata*** (Linnaeus)

Drepane longimana: Richardson, 1846 : 245 (one Vachell fish) (Reeves illustr. No. 241).
Drepane punctata: Günther, 1860, **2** : 62 (two China specimens).

Not listed by Harmer. Identification follows Fowler (1953, p. 12).

Family **SCATOPHAGIDAE**

50. ***Scatophagus argus*** (Linnaeus)

Scatophagus argus: Richardson, 1846 : 245 (two Vachell fishes) (Reeves illustr. No. " 272? ").
Scatophagus argus: Günther, 1860, **2** : 58 (one Reeves and other Chinese specimens).

Listed by Harmer as " ? Fam. ?*Scatophagus argus* (2) ?History "—destroyed. Identification follows Fowler (1953, p. 14).

Family **ACANTHURIDAE**

51. ***Teuthis fuscescens*** (Houttuyn)

Amphacanthus margaritiferus: Richardson, 1846 : 243 (one Vachell specimen, 7 inches) (Reeves illustr. No. 259).
Teuthis albopunctata: Günther, 1861, **3** : 318 (Reeves and other Chinese specimens).

Not listed by Harmer. Identification based on Chu (1931).

Family **SCORPAENIDAE**

52. ***Vespicula trachinoides*** (Cuvier)

Apistes trachinoides: Richardson, 1846 : 213 (one Vachell fish).
Prosopodasys trachinoides: Günther, 1860, **2** : 139 (one Richardson specimen).

Listed by Harmer as *Prosopodasys trachinoides* " ? East Indies "—destroyed. Richardson (p. 213) also lists the British Museum specimen, collected by Sir Edward Belcher. Identification follows Chu (1931).

53. ***Sebastodes vachellii*** (Richardson)

**Sebastes vachellii* Richardson, 1846 : 214 (one Vachell specimen, the TYPE) (Reeves illustr. No. 69?).
Sebastes vachellii: Günther, 1860, **2** : 95 (doubtful species No. 1).

Not listed by Harmer ; not amongst type material in British Museum.

Reeves illustration reproduced here (Plate 2, fig. 3). W. L. Chan (*in litt.*) states that the caption to the Reeves illustration, pronounced in Hong Kong as *Sek-gwau-*

kwung (*Shih kow kung* in the " Report "), refers to one of the commonest of Hong Kong inshore fishes, *Sebastiscus marmoratus* (Cuv.), and that the drawing agrees with this. However, Richardson listed *Sebastes marmoratus* (" Report ", p. 215), based on a Bürger specimen in the British Museum, but was not able to identify a Reeves drawing with it. Further, he speaks of the " uncertainty of the drawing " of *S. vachellii*, citing it as " *Icon.* Reeves, 69? ". Since there are two intergrading colour forms of *S. marmoratus* (Matsubara, 1943, p. 256), it is possible that Richardson did not recognize the Reeves drawing as that species.

Neither Matsubara (*loc. cit.*) nor Chu, Tchang & Chen (1963) mention Richardson's *S. vachellii*, and in the absence of the single Vachell specimen we have merely followed the synonymy of Chu (1931), one of the few authors to list this name.

Family **SYNANCEJIDAE**

54. ***Inimicus japonicus*** (Cuvier)

**Pelor tigrinum* Richardson, 1846 : 212 (one Vachell specimen, the TYPE) (Reeves illustr. No. β42).
Pelor japonicum: Günther, 1860, **2** : 151 (two Reeves specimens).

Listed as *P. japonicum* " China. Rev. G. Vachell " by Harmer—EXTANT. Reeves illustration reproduced here (Plate 3, fig. 1). See Section 5 (p. 154) for notes on extant specimen.

55. ***Minous monodactylus*** (Bloch)

Minous woora: Richardson, 1846 : 213 (one Vachell fish).
Minous monodactylus: Günther, 1860, **2** : 148 (Chinese specimens).

Listed as *M. monodactylus*, " = *Apistus minous*, Cuv. (2) China. Rev. G. Vachell." by Harmer—destroyed. Identification follows Chu, Tchang & Chen (1963).

56. ***Polycaulus uranoscopus*** (Bloch & Schneider)

Synanceia breviceps Richardson, 1844 : 71 (one Reeves and three Vachell fishes).
Aploactis breviceps: Richardson, 1846 : 212 (three Vachell fishes).
Polycaulus elongatus: Günther, 1860, **2** : 175 (one Reeves fish, later cancelled, presumed destroyed).

Listed as " *Polycaulus elongatus* (3) = *Synanceia breviceps*, Richards. China Rev. G. Vachell." by Harmer—destroyed. Identification follows Chu (1931).

Family **PLATYCEPHALIDAE**

57. ***Platycephalus indicus*** (Linnaeus)

Platycephalus insidiator: Richardson, 1846 : 216 (one Vachell specimen).
Platycephalus insidiator: Günther, 1860, **2** : 177 (Reeves and other China specimens).

Listed as *P. insidiator* " China. Rev. G. Vachell " by Harmer, three specimens—destroyed. Identification based on Chu (1931).

58. ***Thysanophrys crocodilus*** (Tilesius)

Platycephalus guttatus: Richardson, 1846 : 217 (one Vachell fish).
Platycephalus guttatus: Günther, 1860, **2** : 183 (no specimens—doubtful species).

Not listed by Harmer. Chu, Tchang & Chen (1963) place Richardson's record in *Inegocia guttata* (Cuvier). The synonymy of Chu (1931) is followed here.

Family **POMACENTRIDAE**

59. ***Amphiprion bicinctus*** (Rüppell)

Amphiprion chrysargyrus Richardson, 1846 : 254 (on Reeves drawing only) (Reeves illustr. No. L26).
Amphiprion clarkii: Günther, 1862, **4** : 5 (Reeves and other China material, including one stuffed fish collected by Reeves, the TYPE of *A. chrysargyrus*).

A. chrysogaster " China. Rev. G. Vachell " is listed by Harmer (possibly an error since that is an Indian Ocean species) 2 fishes—destroyed. Richardson mentions no specimens but based the species on a Reeves drawing ; in fact a Reeves fish (stuffed) is present in the British Museum collections. Fowler (1954) placed Richardson's *A. chrysargyrus* in the synonymy of *A. xanthurus* Cuvier, but the pattern of white bands in the Reeves drawing corresponds much more nearly with Fowler's figure 1 for *A. bicinctus*.

Family **LABRIDAE**

60. ***Halichoeres nigrescens*** (Bloch & Schneider)

**Julis exornatus* Richardson, 1846 : 258 (Bankier specimens from Hong Kong, and Vachell and Reeves material—TYPES).
Platyglossus dussumieri: Günther, 1862, **4** : 143 (Reeves and other China specimens, including TYPES of *Julis exornatus*).

Not listed by Harmer. Günther listed China specimens as types of *J. exornatus* (BMNH. 1851.12.27.1634). The Vachell fishes can be considered to have been syntypical material. Two Richardson specimens in British Museum from Hong Kong (BMNH. 1848.3.8.6 and 1868.3.19.833). It is possible that these are Vachell specimens, but there is no evidence to show it. Reeves illustration reproduced here (Plate 3, fig. 4). Identification based on Fowler (1956, p. 230).

Family **GOBIIDAE**

61. ***Glossogobius giuris*** (Ham. Buch.)

Gobius fasciato-punctatus: Richardson, 1846 : 204 (Vachell fish or fishes) (Reeves illustr. No. 146).
Gobius giuris: Günther, 1861, **3** : 21 (Reeves type of *G. fasciato-punctatus* in British Museum and other China specimens).

Not listed by Harmer. Identifications and synonymies for the eleven gobioid species listed here have been based on Koumans (1931, 1953).

62. ***Glossogobius brunneus*** (Tem. & Schl.)

**Gobius platycephalus* Richardson, 1846 : 204 (one Vachell fish, the TYPE, " not in very good condition ") (Reeves illustr. No. L94).
Gobius platycephalus: Günther, 1861, **3** : 5 (doubtful species No. 39, related to *G. brunneus*).

Not listed by Harmer. In the addenda to the " Report " Richardson states (p. 318) that he had just seen the description of *G. brunneus* by Temminck and Schlegel and he considered his *G. platycephalus* probably identical to that species. Vachell fish not amongst types in British Museum. Reeves illustration reproduced here (Plate 3, fig. 3). Fowler (1960) considered *G. brunneus* a synonym of *G. giuris*.

63. ***Cryptocentrus filifer*** (Valenciennes)

Gobius filifer: Richardson, 1846 : 205 (Vachell material).
Gobius knutteli: Günther, 1861, **3** : 73 (Reeves and other China specimens).

Listed as *G. knutteli* " China. Rev. G. Vachell." by Harmer—destroyed. A second Vachell specimen listed by Harmer as " [Origl. label = *G. filifer*] (probably the specimen alluded to by Richardson, in Brit. Assn. Report, 1845, p. 205) "—destroyed also.

64. ***Rhinogobius margariturus*** (Richardson)

**Gobius margariturus* Richardson, 1846 : 205 (one, perhaps more, Vachell specimens—TYPE) (no Reeves illustr.).
Gobius margariturus: Günther, 1861, **3** : 47 (on Richardson, no specimens listed).

As *G. margariturus* " China. Rev. G. Vachell " in Harmer's list—destroyed. Vachell specimen not amongst types in British Museum. Fowler (1960) placed this species in *Ctenogobius* and commented " A rare species, apparently not seen since described in 1846."

65. ***Drombus ripilepis*** (Richardson)

**Gobius ripilepis* Richardson, 1846 : 205 (one Vachell fish, the TYPE, $3\frac{1}{3}$ inches) (no Reeves illustr.).
Gobius ripilepis: Günther, 1861, **3** : 5 (doubtful species No. 28, apparently allied to *G. kokius* ").

Not included in Harmer's list. Placed in *Ctenogobius* by Fowler (1960).

66. ***Acanthogobius stigmothonus*** (Richardson)

**Gobius stigmothonus* Richardson, 1844 : 147, and 1846 : 205 (two Vachell fishes of 5 or 6 inches —the TYPES) (no Reeves illustr.).
Gobius stigmothonus: Günther, 1861, **3** : 76 (no specimens).

Listed as *G. stigmothonus* (3 fishes) " China. Rev. G. Vachell " by Harmer—destroyed. The species was described by Richardson in the *Zoology of the Sulphur* (1844, p. 147) and was based on " . . . several specimens . . . brought from Canton by the Rev. George Vachell ". The Vachell specimens are not amongst the types in the British Museum.

67. *Apocryptes serperaster* (Richardson)

**Apocryptes serperaster* Richardson, 1846 : 206 (two Vachell specimens, 6 inches in length—the TYPES) (Reeves illustr. No. β55).
Apocryptes serperaster: Günther, 1861, **3** : 82 (Reeves and other China specimens).

Listed by Harmer as *A. serperaster* " ? China Rev. G. Vachell [labelled " Reeves "]" —destroyed. The words " Rev. G. Vachell " are crossed out, perhaps when the reference to Reeves was added. A Reeves specimen of 6 inches is in the British Museum, now labelled as a type, BMNH. 1965.8.12.51. It has a metal tag tied to the jaw " 19.2.3.". Reeves illustration reproduced here (Plate 3, fig. 2).

Family **PERIOPHTHALMIDAE**

68a. *Boleophthalmus pectinirostris* (Linnaeus)

Boleophthalmus boddaerti: Richardson, 1846 : 208 (Vachell material) (Reeves illustr. No. β38).
Boleophthalmus boddaerti: Günther, 1861, **3** : 102 (Indian Ocean specimens only).

Not included in Harmer's list. Fowler (1962) distinguished *B. boddaerti* (Pallas) from *B. pectinirostris* mainly on the presence in the former of dark transverse badns on the body. The Reeves drawing does not show these bands.

68b. *Boleophthalmus pectinirostris* (Linnaeus)

Boleophthalmus pectinirostris: Richardson, 1846 : 208 (one Vachell fish, 2·80 inches).
Boleophthalmus pectinirostris: Günther, 1861, **3** : 102 (Reeves specimen).

Not included in Harmer's list. Unregistered Reeves specimen in British Museum of 132 mm. tot. l., and an unregistered Haslar specimen of 106·5 mm. tot. l., labelled merely " 158 ". Both are too large to have been the Vachell fish.

69a. *Scartelaos histophorus* (Valenciennes)

Boleophthalmus aucupatorius Richardson, 1844 : 148, and 1846 : 208 (Vachell material).
Boleophthalmus viridis: Günther, 1861, **3** : 104 (" b,c. Half-grown. China. Presented by Sir J. Richardson—Types of *B. aucupatorius.*").

Not included in Harmer's list. Described by Richardson in the *Zoology of the Sulphur* (1844, p. 148), based on fishes collected by Sir Everard Home, John Reeves and the Rev. George Vachell. Two Chinese specimens in the British Museum (BMNH. 1965.8.12.52–3) presented by Richardson ; the larger of the two (2·65 inches total length) is undoubtedly Richardson's measured and figured specimen. There is no indication, however, that these are Vachell specimens.

69b. *Scartelaos histophorus* (Valenciennes)

Boleophthalmus campylostomus Richardson, 1846 : 209 (no specimens, see below) (Reeves illustr. No. β52).
Boleophthalmus campylostomus: Günther, 1861, **3** : 101 (doubtful species No. 2).

Listed by Harmer as the type of *B. campylostomus*, ' China. Rev. G. Vachell "—

EXTANT. Richardson, however, based his description solely on the Reeves drawing, stating " Of this fish we have seen no specimen." This Cambridge specimen was presented to the British Museum (BMNH. 1917.7.14.89) and has hitherto been labelled wrongly as a type. See Section 5 (p. 155) for description and notes.

Family **GOBIOIDIDAE**

70a. ***Taenioides anguillaris*** (Linnaeus)

Amblyopus rugosus: Richardson, 1846 : 207 (Vachell material) (Reeves illustr. No. β7).
Amblyopus rugosus: Günther, 1861, **3** : 133 (doubtful species No. 4—" Typical specimens in Cambridge Museum ").

Not included in Harmer's list. The synonymy of Fowler (1962) is followed for the two Richardson *Amblyopus* records.

70b. ***Taenioides anguillaris*** (Linnaeus)

Amblyopus anguillaris: Richardson, 1846 : 207 (two Vachell fishes, 4·80 inches).
Amblyopus hermannianus: Günther, 1861, **3** : 135 (one China specimen).

Listed as " *Amblyopus hermannianus* = ' *A. anguillaris* '. China. Rev. G. Vachell " by Harmer—destroyed.

Family **TRYPAUCHENIDAE**

71. ***Trypauchen vagina*** (Bloch & Schneider)

Trypauchen vagina: Richardson, 1846 : 206 (Vachell material) (Reeves illustr. No. β57).
Trypauchen vagina: Günther, 1861, **3** : 137 (China specimens).

Listed by Harmer as *T. vagina*, three specimens " ? Histy."—destroyed. Identification follows Fowler (1962).

Family **CALLIONYMIDAE**

72. ***Callionymus hindsii*** (Richardson)

Callionymus hindsii: Richardson, 1846 : 210 (one Vachell fish).
Callionymus hindsii: Günther, 1861, **3** : 146 (four Belcher specimens—the types of *C. hindsii*).

Listed as *C. hindsii* " China. Rev. G. Vachell " by Harmer—destroyed. Identification based on Fowler (1959).

73. ***Callionymus japonicus*** (Houttuyn)

Callionymus reevesii Richardson, 1844 : 60 (one Belcher fish) and 1846 : 210 (two female fishes, Vachell) (Reeves illustr. No. 180—female according to Richardson).
Callionymus longecaudatus: Günther, 1861, **3** : 148 (China specimens).

Harmer listed two specimens of *C. longecaudatus* = " *C. reevesii* ♀ ' Zool. of Sulph.' by Richards."—destroyed. These are not the types, since Richardson described

this species (*Voyage of the Sulphur*, 1844, p. 60) on a single specimen collected by Sir Edward Belcher, which he considered a male. Günther (1861, p. 145) tentatively placed Richardson's female (i.e. Vachell) *C. reevesii* in the synonymy of *C. curvicornis* Valenciennes, and placed the male in *C. longecaudatus* Temm. & Schl.; but in a note on the latter species (p. 148) he cites Bleeker's opinion that all Chinese specimens should be referred to *C. reevesii*. Fowler (1959) considered *C. reevesii* a junior synonym of *C. japonicus*, although he placed Richardson's *Voyage of the Sulphur* figure in *C. curvicornis* (referring to it as a female).

Family **MUGILOIDIDAE**

74. ***Parapercis pulchella*** (Temm. & Schl.)

Percis pulchella: Richardson, 1846, 211 (one Vachell fish).
Percis pulchella: Günther, 1860, **2** : 240 (Japan and Haslar specimens).

Not listed by Harmer. Richardson suspected that *P. pulchella* was merely a variety of *P. nebulosa* Cuvier. Identification follows synonymy of Chu (1931).

Family **URANOSCOPIDAE**

75. ***Uranoscopus japonicus*** (Houttuyn)

Uranoscopus asper: Richardson, 1846 : 211 (one Vachell fish) (Reeves illustr. Nos. 162 and 166).
Uranoscopus asper: Günther, 1860, **2** : 228 (Japanese specimens).

Listed as *U. asper* " China. Rev. G. Vachell " by Harmer—destroyed. Identification based on Chu, Tchang & Chen (1963).

Family **TRIACANTHIDAE**

76. ***Triacanthus biaculeatus*** (Bloch)

Triacanthus biaculeatus: Richardson, 1846 : 202 (no Vachell material) (Reeves illustr. No. a24).
Triacanthus brevirostris: Günther, 1870, **8** : 209 (Reeves and other China specimens).

Listed as *T. brevirostris* " China. Rev. G. Vachell " by Harmer, 2 fishes—EXTANT. These specimens may have been overlooked by Richardson. The latter evidently misidentified the Reeves drawing, which from its coloration is definitely *T. brevirostris*. For notes and description of the two extant specimens, see Section 5 (p. 156).

Family **BALISTIDAE**

77. ***Abalistes stellatus*** (Bloch & Schneider)

**Balistes vachellii* Richardson, 1844 : 129, and 1846 : 201 (one Vachell specimen—the TYPE).
Balistes stellatus: Günther, 1870, **8** : 212 (one China specimen, very young, Belcher).

Included in Harmer's list as *B. stellatus* " No histy."—destroyed. Richardson based his description of this species (*Zoology of the Sulphur*, p. 129) on a single Vachell specimen of " 3·75 inches " preserved in spirit. Identification follows synonymy of Chu (1931).

78. *Alutera scripta* (Osbeck)

Aleuteres laevis: Richardson, 1846 : 202 (no specimens mentioned).
Monacanthus scriptus: Günther, 1870, **8** : 252 (no China specimens).

Listed as *M. scriptus* " China. Rev. G. Vachell " by Harmer, 2 fishes—destroyed. These were either missed by Richardson or were not true Vachell fishes. Identification based on Chu (1931), but generic allocation follows Schultz (1966).

Family **TETRAODONTIDAE**

79. *Fugu* (*Torafugu*) *ocellatus* (Linnaeus)

Tetrodon ocellatus: Richardson, 1846 : 199 (no Vachell material mentioned) (Reeves illustr. Nos. 96 *O* and 271).
Tetrodon ocellatus: Günther, 1870, **8** : 279 (Reeves and other China specimens).

Listed by Harmer as *T. ocellatus* two specimens " China. Rev. G. Vachell "—destroyed. Harmer also listed an exhibited specimen F4227, (EXTANT, 102 mm S.L., 127 mm. tot. l.), but it seems doubtful that this is a Vachell specimen since Richardson mentions spirit specimens only in the " British Museum and Chinese collection at Hyde Park ". See Section 5 (p. 157) for notes on this specimen.

Family **ECHENEIDAE**

80. *Echeneis naucrates* (Linnaeus)

Echeneis naucrates: Richardson, 1846 : 203 (no Vachell material mentioned) (Reeves illustr. No. 97h).
Echeneis naucrates: Günther, 1860, **2** : 384 (Reeves and Richardson specimens).

Listed as *E. naucrates* in the Exhibited Catalogue No. F.2917 " Specimen in spirit. China Seas. Cambridge Philosl. Society's Colln." This specimen is still extant—see notes on p. 157. (There is another extant specimen listed by Harmer in the non-exhibited catalogue as " (juv.) ? History.) "

5. EXTANT VACHELL SPECIMENS

Apart from one, the few remaining extant specimens from the Vachell collection are in the University Museum of Zoology in Cambridge. The exception is a single fish sent from Cambridge to the British Museum (Natural History), *Boleophthalmus campylostomus*, which is labelled " Vachell ", but in this case Richardson clearly stated that he had seen no specimens of that species. The extant specimens in Cambridge mostly bear recent labels indicating their origins. Authority for this presumably derives from Harmer's catalogue, unless contemporary labels once existed and were subsequently destroyed ; Harmer only once mentions such an original label, i.e. for *Cryptocentrus filifer* (p. 143). In only one instance is there a label tied to the fish (*Coilia playfairii*), but even then the label merely states the name of the fish and not its origin. In the case of the Exhibited Series at Cambridge, the

name of the species, the place of capture and the collector are inscribed, either on a porcelain plate supporting the specimen (e.g. for *Anguilla clathrata* and *Caranx armatus*), or on a small " perspex " plate glued inside a modern " perspex " box. In a few cases, the size of the specimen agrees with that given by Richardson in his description and the fish can be certainly identified as one of the Vachell collection. But in most cases this is not possible ; either Richardson gives no lengths, or else the specimen has been listed by Harmer as " Vachell " but is not mentioned by Richardson. Thus there can be no certainty of the number of extant Vachell specimens.

In the following descriptions and notes we have included eleven species (fifteen specimens) which may be Vachell material :

No. 5. " *Coilia playfairii* " (=*Coilia playfairii*)
No. 7. " *Anguilla clathrata* " (=*Anguilla japonica*) HOLOTYPE
No. 18. " *Holocentrum albo-rubrum* " (=*Holocentrus ruber*)
No. 23. " *Trichiurus intermedius* " (=*Lepturacanthus savala*)
No. 25. " *Seserinus vachellii* " (=*Parastromateus niger*) SYNTYPES
No. 30. " *Caranx ciliaris* " (=*Citula armata*)
No. 54. " *Pelor tigrinum* " (=*Inimicus japonicus*) HOLOTYPE
No. 69*b*. " *Boleophthalmus campylostomus* " (=*Scartelaos histophorus*)
No. 76. " *Triacanthus biaculeatus* " (=*Triacanthus biaculeatus*)
No. 79. " *Tetrodon ocellatus* " (=*Fugu* (*Torafugu*) *ocellatus*)
No. 80. " *Echeneis naucrates* " (=*Echeneis naucrates*)

The following abbreviations have been used in the descriptions of specimens :

D	dorsal fin rays	S.L.	standard length
P	pectoral fin rays	tot. l.	total length
V	pelvic fin rays	BMNH.	British Museum (Natural History)
A	anal fin rays		
g.r.	gillrakers	UMZC.	University Museum of Zoology, Cambridge (non-exhibited catalogue, roman numbers ; exhibited catalogue, F numbers).
Br.St.	branchiostegal rays		

Unless stated otherwise, measurements were made in the following manner :

body depth: usually under dorsal origin, otherwise at deepest point.
head length: from premaxillary symphysis to edge of operculum, the longest measurement (i.e. not always horizontal).
gape: from dentary symphysis to angle of jaw.
upper jaw: from snout tip to posterior tip of maxilla.

In the fin ray formulae, spines are indicated in roman capitals, simple rays in lower case roman numerals, and branched rays in arabic numerals. Scutes are expressed as pre-pelvic and post-pelvic, with the scute lying between the pelvic fins counted as the first post-pelvic scute.

5. " *Coilia playfairii* "

= ***Coilia playfairii*** (McClelland, 1844)

A single fish, 268·5 mm. S.L. (290 mm. tot. l., caudal tip broken), scales mostly shed, otherwise in fair condition, label tied to caudal peduncle " *Coilia mystus* Engrauli[dae] ", modern label in bottle giving locality as " Canton " but with no mention of Vachell, UMZC. VII, 404 (catalogued as " Fishes from China ". Canton).

Description. Br.St. 12, D I + iii 11, P 7 free + 11 (left) and 7 free + 12 (right), V i 6, A ii 84, g.r. 28, scutes 15 + 26.

In percentages of standard length : body depth 17·9, head length 16·8 ; snout length 3·7, eye diameter 3·4, length of upper jaw 22·0, length of lower jaw 11·9 ; pectoral fin length 37·9 (filaments) and 10·9 (longest branched ray), pelvic fin length 7·1, length of anal base 55·4 ; pre-dorsal distance 29·3, pre-pelvic distance 26·2, pre-anal distance 41·3.

Head a little broader than body. Body compressed, its width 3 times in its depth, belly sharply keeled, with scutes beginning on isthmus ; ascending arms of post-pelvic scutes alternately long and short. Maxilla reaching beyond base of first pectoral ray by about 1 eye diameter, toothed along entire lower border ; two supra-maxillae present, the second expanded posteriorly and curved downwards at its tip, the first longer than deep. Lower jaw, with prominent knob at symphysis, rising posteriorly to form high coronoid process.

Gillrakers moderately slender, about 4/5 eye diameter and 1½ times length of corresponding gill filaments ; gillraker serrae of even length except those near the tips of the rakers ; no gillrakers on the posterior face of the 3rd epibranchial. Muscular portion of isthmus reaching forward to the hind border of the branchiostegal membrane.

Dorsal preceded by small spine ; dorsal origin slightly behind pelvic origin. Pectoral with seven long filaments, separate throughout their length, tip of longest filament reaching to base of 15th anal branched ray. Pelvic base nearer to base of 1st pectoral ray than to anal origin by 1½ eye diameters. Posterior part of body not tapering to a point, 6·5 mm. deep at caudal base. Anal origin behind vertical from last dorsal ray by 3 eye diameters.

Colour: upper ¼ light brown, rest of flanks silvery except for narrow brown strip above base of anal finrays in posterior half of fin. Fins hyaline.

Note: Richardson stated that specimens of *C. playfairii* existed in all the Chinese collections which he examined, but he does not specifically mention any Vachell material. Further notes on this species are given by Whitehead (1966).

7. " *Anguilla clathrata* "

= ***Anguilla japonica*** Temminck & Schlegel, 1846

A single fish, 228 mm. S.L. (232 mm. tot. l.) in good condition, mounted for exhibition with printed label " *Anguilla vulgaris* China. Rev. G. Vachell ", UMZC.

F.2002. Originally catalogued as VIII 28 *Anguilla vulgaris*. China. Rev. G. Vachell, and subsequently transferred to the exhibited series. HOLOTYPE of *Anguilla clathrata* Richardson.

DESCRIPTION. Br.St. (not recorded), D 225, P i 16, A 222 (counts made from radiograph of holotype).

In percentages of standard length : body depth 4·2, head length 10·5 ; snout length 1·8, eye diameter 0·95, interorbital width 1·2, gape 2·58 ; pectoral fin length 3·4 ; pre-pectoral distance 10·6, pre-dorsal distance 29·4, pre-anal distance 38·2 ; distance between verticals from dorsal and anal origins 9·6.

Pre-anal length without head 27·3% of total length. Distance between verticals from dorsal and anal origins 9·5% in total length (i.e. slightly less than head length). Gape 24·7% in head length, eye diameter 9·0% in head length.

Lower jaw projecting slightly. Maxillary tooth bands with two rows of conical teeth with a longitudinal groove between them. Average breadth of pre-maxillary-vomerine tooth band only slightly greater than the width of the maxillary bands ; the former with 2–3 longitudinal rows of teeth.

Vertebrae 115, of which 44 are prehaemal (from radiograph).

Colour: back and flanks light brown, becoming almost cream on the belly ; no evidence that the flanks were ever marbled or mottled. Fins hyaline, but a distinct dark brown margin round the posterior 12 mm. of the tail region.

Note: In his revision of the genus *Anguilla*, Ege (1939) omitted a number of names from his synonymies, some of which were discussed later in the text, but not the name *clathrata*. Günther's apparent neglect of the type of *Anguilla clathrata* has probably accounted for the fact that it has been generally overlooked. It is listed as distinct from *A. japonica* by Chu (1931), but this author did not examine the type.

Following the keys and descriptions of Ege (*loc. cit.*) the present specimen is undoubtedly *Anguilla japonica*. The tooth bands in the upper jaw resemble those shown for a typical specimen by Ege (*loc. cit.*, Pl. 23, fig. 5). The positions of the dorsal and anal fins agree with the formulae given by Ege, as also the relation between the gape of the mouth and the length of the head. Of great importance is the dark margin round the tail, a character stated by Ege to occur only in *A. japonica*. On geographical grounds, the only other species likely to be found in that area is the mottled eel *Anguilla marmorata* Quoy & Gaimard. In that species, however, the distance between the verticals from dorsal and anal origins much exceeds the length of the head. Also, Ege gives the vertebral numbers for *A. marmorata* as 100–110 (115 in the type of *Anguilla clathrata*). *Anguilla borneensis* Popta, another possibility, also has a much lower vertebral count (103–108).

The name *Anguilla japonica* Temm. & Schl. has been very widely used for the Japanese freshwater eel for over a century. Unfortunately, the name *Anguilla clathrata* pre-dates it by two years, and is not a *nomen oblitum* since it was used as a senior synonym by Chu (1931). It would, however, be greatly in the interests of stability if the name *japonica* were retained, and an application to the International Commission has been made (Whitehead, 1966*a*).

18. " *Holocentrum albo-rubrum* "

= *Holocentrus ruber* (Forsskål, 1775)

Two fishes, 131·2 and 137·7 mm. S.L. (175 and 166 mm. tot. l., estimated for larger fish since caudal tips damaged), in fair condition, modern label " *Holocentrum rubrum* China Rev. G. Vachell " (repeat of entry in catalogue), UMZC. I, 35.

Description. (figures for the larger fish cited first) Br.St. 7 and 7, D XI 14 and XI 14, P 2 + i 12 and 2 + i 12, V I 7 and I 7, A IV 9 and IV 9, g.r. 6 + 10 and 8 + 10, scales 36 and 36, $2\frac{1}{2}/7$ and $2\frac{1}{2}/7$, 6 predorsal, 5 series on cheek, 1 series on operculum.

In percentages of standard length : body depth 38·0 and 39·6, head length (excluding opercular spine) 32·8 and 33·2 (including spine, 36·4 and 37·4) ; snout length 8·3 and 7·9, eye diameter 11·7 and 12·3, interorbital width (above eye centre) 8·0 and 9·4, upper jaw length 14·1 and 14·5 ; caudal peduncle, length 13·4 and 13·3, depth 9·7 and 10·2—length depth ratio 1·38 and 1·71.

Body deep, compressed, its width 1·45 times in its depth. Upper profile descending rather abruptly from occiput to snout tip. Jaws equal, maxilla almost reaching to vertical from eye centre, expanded distal portion $2\frac{3}{4}$ in eye. Nostrils two, close together and lying immediately in front of the eye ; bony ridges in front of nostril ending in blunt spine over pre-maxilla. Lower border of preorbital with small spines, anterior one largest ; upper pre-orbital ridge with triangular spine below anterior eye border, directed laterally. Infra-orbital and post-orbital finely denticulated. Two flat spines at upper angle of operculum, upper one longest and reaching back beyond gill opening ; posterior part of operculum with parallel ridges ending in sharp serrae along posterior border. Pre-opercular spine stout, about 7/8 eye diameter ; outer borders of pre-operculum and suboperculum with fine serrae. Fronto-parietal region with about 8 parallel ridges, one on each side extending forward between the orbits ; a patch of fine denticulations above posterior half of eye.

Dorsal origin above tip of lower opercular spine ; spines stout, the 4th longest, space between the 1st and 2nd narrow ; membranes between spines deeply incised. Anal with 3rd spine longest, about twice eye diameter, 1st spine minute. Pelvic origin below vertical from between 2nd and 3rd dorsal spines ; pelvic spine about $1\frac{3}{4}$ times eye diameter.

Colour: Light brown, with the appearance of about seven longitudinal light fawn lines down the flanks (along scale rows). Smaller fish with dark markings at the base of the upper opercular spine, in the membrane between the first two dorsal spines, at the base of the soft part of the dorsal, at the tips of the pelvic soft rays, in the membrane between the 3rd anal spine and the first of the branched anal rays, and along the outer caudal rays. Richardson states " There is none of the yellow colour on the fins which the preceding species [i.e. *H. spinosissimus*] shows ".

Note: these two specimens agree well with the diagnosis and description of Yu (1963), and it must be presumed that the colours were sufficiently well retained when Richardson examined them for him to distinguish these fishes from the closely related

H. spinosissimus Temm. & Schl., of which he had a single specimen (Reeves). Yu (*loc. cit.*) records *H. ruber* as the commonest species of *Holocentrus* in the Taiwan region.

23. " *Trichiurus intermedius* "

= *Lepturacanthus savala* (Cuvier, 1829)

A single fish, 372 mm. S.L. (376 mm. tot. l.), in good condition, mounted for exhibition with printed label " *Trichiurus muticus* Hair Tail China Rev. G. Vachell ", UMZC. F.2685.

Description. Br.St. 6, D iv 111, P i 10, V (absent), A I 82, g.r. 5 + 6–7.

In percentages of standard length : body depth 5·4, head length 11·5 ; snout length 4·36, eye diameter 1·67, upper jaw length 5·0, lower jaw length 7·37 ; pectoral length 4·31 ; pre-dorsal distance 8·4, pre-anal distance 29·5.

Body elongate, tapering, its depth 18·7 times in total length. Head 8·8 times in total length. Lower jaw strongly projecting, with prominent mental lobe. Frontal ridges converging posteriorly to form fairly prominent sagittal crest at nape, the ridge not continued forward onto the ethmo-frontal region. Lower margin of suboperculum slightly concave. Teeth in both jaws caniniform, fang-like anteriorly in the upper jaw. Eye 6·9 times in head (14·5% of head length).

Pectoral fins short, pelvic fins absent. First four dorsal rays weakly spinous, the last about equal in length to the first soft ray. First spinous anal ray apparently absent, second ray enlarged, spinous, 3·1 mm. in length ($\frac{1}{2}$ eye diameter) ; anal rays breaking through skin as pungent spinules. No caudal.

Lateral line dipping down sharply behind the pectoral fin base, and thereafter running along the lower $\frac{1}{3}$ of flank.

Colour: very pale brown, with a white midlateral line ; fins colourless.

Note: the large post-anal scute (i.e. anal spine I), the presence of pungent anal spinules and the small eye, were used by Tucker (1956) to distinguish *Lepturacanthus* from *Trichiurus*. The present specimen agrees well with Tucker's diagnosis of this monotypic genus.

Harmer listed this fish as *Trichiurus muticus*, a species which Richardson (1846, p. 268) placed in the synonymy of " *Trichiurus lepturus, japonicus* Temm. & Schl.". [Tucker (*loc. cit.*) regarded *T. muticus* Gray as a member of *Eupleurogrammus* Gill, but considered *T. lepturus* Linn. as a true *Trichiurus*]. It is difficult to know how the present specimen came to be labelled *T. muticus* since Richardson does not mention Vachell specimens under any of the three species of *Trichiurus* listed (*T. armatus* Gray, 1831, in the synonymy of which he placed *T. savala* Cuvier ; *T. lepturus* ; and *T. intermedius*). A Reeves illustration exists only for the first of these species. It must be presumed that Richardson either overlooked this Cambridge specimen or that he failed to mention it under *Trichiurus armatus*, only listing the British Museum specimen.

25. " *Seserinus vachellii* "

= *Parastromateus niger* (Bloch, 1795)

Two fishes, 56·6 and 74·7 mm. S.L. (66·8 and 91·1 mm. tot. l.), caudal tips slightly damaged, otherwise in fair condition, modern label in jar " *Platax teira* China Rev. G. Vachell ", UMZC. II, 492 (repeat of entry in catalogue). SYNTYPES of *Seserinus vachellii* Richardson.

DESCRIPTION. (based on the larger of the two specimens, 74·7 mm. S.L.) D 5 rudimentary + I 41, P i 22, V i 5, A 2 rudimentary + I 37, g.r. 6 + 15.

In percentages of standard length : body depth 65·5, head length 31·5 ; snout length 9·4, eye diameter 9·1 ; pectoral fin length 23·0, pelvic fin length 13·5, non-rudimentary dorsal spine 14·2, longest branched dorsal ray 41·2, non-rudimentary anal spine 11·1 ; length of dorsal base 64·0, length of anal base 57·4 ; pre-dorsal distance 47·4, pre-pelvic distance 25·8, pre-anal distance 50·9.

Body strongly compressed, rhombic, dorsal and ventral profile angular. Head with its nuchal contour keeled. A single series of small conical teeth in each jaw. Adipose eyelid barely developed. Mouth a little oblique, maxilla reaching to anterior border of eye. Operculum with faint radial striae.

Dorsal preceded by an antrorse spine, followed by five small retrorse spines and a large spine (about ½ head length) ; 5th branched ray longest, much greater than head length, the rays decreasing in length thereafter. Two rudimentary anal spines, embedded in the skin ; first non-rudimentary anal spine a little larger than eye diameter. Pelvic base below vertical from posterior border of eye.

Caudal peduncle narrow, its depth less than eye diameter. Caudal deeply forked.

Minute cycloid scales present on body. Lateral line scales becoming scuted in posterior ¼ of body, the scutes shield-shaped with a single point.

Colour: flanks light brown, belly lighter, becoming white. Fins hyaline, but dark brown markings on anterior part of dorsal and anal and on upper surface of pelvic fins.

Note: Harmer did not list any specimens under Richardson's name *Seserinus vachellii*. On the other hand, he listed the present specimens as " *Platax teira* ". Even a cursory glance at the specimens in the bottle shows that they are not *Platax* (chiefly the lack of filamentous rays), which suggests that the identification was not made by Günther but was perhaps the result of a curatorial error. The larger syntype tallies with the size given by Richardson.

The name *Formio* was proposed by McCulloch (1929) as a replacement name for *Apolectis* Cuvier, 1832, which was preoccupied by *Apolectis* Bennett, 1831. De Beaufort & Chapman (1951, p. 458) resurrected the name *Parastromateus* Bleeker, 1865 for this genus, and after some hesitation placed this monotypic genus amongst the carangids. McCulloch (*loc. cit.*) had proposed a separate family, the Formiidae, and it is significant that Suzuki (1962), in a comprehensive revision of the Japanese members of the family Carangidae, did not include the present species. We have here followed McCulloch.

The Vachell specimens agree well with the description of the species by De Beaufort & Chapman except in one respect. The 5th branched dorsal ray is over four times as long as eye diameter ; their statement " which is as long as eye " seems to be an error.

30. " *Caranx ciliaris* "

= *Citula armata* (Forsskål, 1775)

A single fish, 88 mm. S.L. (111 mm. tot. l.), mounted for exhibition in glass jar and labelled " *Caranx armatus* " but with no indication of the place of capture or donor, UMZC. F.2755 (catalogued as China. Cambridge Philosoph. Society's Collection).

Both Richardson (1846, p. 276) and Harmer list a Cambridge Philosophical Society specimen but do not state if it was a Vachell fish, nor do they give any indication of the size of the specimen. This fish must be considered as only doubtfully part of the Vachell collection.

For the identification of this specimen we have followed Suzuki (1962).

54. " *Pelor tigrinum* "

= *Inimicus japonicus* (Cuvier, 1829)

A single fish, 191 mm. S.L. (242 mm. tot. l.), in good condition, modern label only " *Pelor japonicum* China Rev. G. Vachell ", UMZC. II, 151 (repeat of entry in catalogue). HOLOTYPE of *Pelor tigrinum* Richardson.

DESCRIPTION. D XVII 7, P 12, V I 5, A II 9, g.r. 2 + 6, pores in lateral line 16.

In percentages of standard length : body depth 36·1, body width 26·2, head length 33·0, head width 35·0 ; snout length 14·3, eye diameter 4·6, interorbital width (above eye centre) 10·7, upper jaw length 17·7, post-orbital distance 13·9 ; pre-dorsal distance 23·8, pre-pelvic distance 25·1, pre-anal distance 60·7 ; depth of caudal peduncle 10·5.

Body a little deeper than wide, head about as wide as deep. Snout length equal to post-orbital distance ; posterior half of snout without narrow longitudinal keel. Mouth moderate, oblique, maxilla reaching to vertical from anterior eye border. Lower jaw projecting when mouth closed, symphysial knob evident ; teeth villiform, in a moderate band in each jaw and on vomer. Orbits well raised, with deep interorbital cavity and transverse ridge linking orbits posteriorly ; deep rectangular depression across occiput ; parietal ridges high, bluntly pointed. Operculum with two ridges, the upper largest and terminating in a blunt spine. Pre-operculum with two spines.

Dorsal origin more than one eye diameter behind orbits ; first three dorsal spines separated from remainder of fin by deep excavation in fin membrane ; longest dorsal spine (7th) 19·2% of S.L., penultimate spine 17·8%, last spine 18·3%, longest soft dorsal ray (3rd) 20·9%. Pelvic about as long as head, entirely adnate, tip of last ray reaching vent. Pectoral equal to head length, its origin below base of 3rd dorsal spine, its tip reaching to vertical from 13th dorsal spine ; two detached rays present. Head, body, dorsal and pectoral covered with small dermal tubercles, and small dermal flaps present posteriorly at tips of dorsal spines.

Colour: most of body and head white except (apparently) parts which have been less exposed to the light, i.e. where right flank is covered by the pectoral and where the dorsal is folded over part of the left flank. In these areas there is evidence of brown

mottling, but no overall colour pattern can be distinguished now.

Note: Richardson (1846, p. 212) listed five species of *Pelor: P. japonicum, P. aurantiacum, P. tigrinum, P. cuvieri* and *P. sinense.* Matsubara (1943), whose work has been followed in identifying the present specimen, considered the first three of these nominal species as synonyms.

69b. " *Boleophthalmus campylostomus* "

= *Scartelaos histophorus* (Valenciennes, 1837)

One fish, 70·5 mm. S.L., caudal tip broken, otherwise in good condition, jar labelled " *Boleophthalmus campylostomus* (TYPE) China. Vachell ", formerly in Cambridge, now in the British Museum (Natural History), BMNH. 1917.7.14.89 (catalogued by Harmer as " *Boleophthalmus campylostomus* Richards. TYPE China. Rev. G. Vachell").

DESCRIPTION. D_1 v, D_2 i 26, P 19, V i 5, A i 27

In percentages of standard length : body depth 14·2, body width 9·4, head length 24·5, head width 13·5 ; snout length 4·7, eye diameter 4·25, length of upper jaw 9·5, length of lower jaw 8·8 ; pectoral fin length 12·5, pelvic fin length 11·1, length of 1st dorsal base 5·5, height of 1st dorsal fin 25·0, height of 2nd dorsal fin 5·4 ; pre-1st dorsal distance 36·2, pre-2nd dorsal distance 53·4, pre-anal distance 54·8.

Body moderately elongate, subcylindrical anteriorly, a little compressed posteriorly, its width 1·5 times in its depth. Head a little depressed, its width twice in its length. Snout blunt, a little greater than eye diameter. Eyes close together, lower eyelid well developed. Upper jaw prominent, tip of maxilla almost reaching to vertical from posterior border of eye ; a single series of teeth present in each jaw ; upper jaw with 7–8 curved caninoid teeth with bluntly pointed tips, and a number of smaller and more closely-set teeth, almost concealed, lying nearer to angle of jaw ; lower jaw with a well-developed symphysis bearing a large canine on each side, and about 8 caninoid teeth along jaw with blunt tips (not obliquely truncate), followed by a short series of closely-set smaller caninoid teeth partly concealed. A series of 4 barbels along posterior half of lower jaw ramus, and a single larger mental barbel. Gill openings narrow, oblique, extending from middle of pectoral base to just above pelvic base.

First dorsal fin elongate, a little longer than head length, the 3rd ray the longest. Second dorsal fin low (less than half body depth), last ray not (?now) connected with caudal fin. Pectoral fin rounded, with fleshy base, its tip reaching to just beyond vertical from base of last ray in first dorsal fin. Pelvic fins united, joined to body along almost half their length, tips reaching to vertical from origin of 1st dorsal fin. Anal fin long and low, its origin below 2nd branched ray of 2nd dorsal fin, not (?now) joined to caudal fin posteriorly. Caudal fin damaged.

Head and anterior parts of body covered with warty skin. Scales present from halfway along anal fin to base of caudal fin, minute, partly embedded.

Colour: very pale fawn grading to a cream colour on the flanks and belly ; no sign of spots on the body. Fins white.

Note: This specimen has hitherto been labelled *Boleophthalmus campylostomus*, but re-examination shows that small barbels are present under the lower jaw, a character diagnostic of the monotypic genus *Scartelaos* Swainson. Also, the lower jaw teeth are blunt but are not obliquely truncate, as they are in *Boleophthalmus*. The barbels in the present specimen are not as numerous as shown in the figure given by Koumans (1953, figure 65), or as in the Richardson type of *B. aucupatorius* (=*Scartelaos histophorus*), and this may account for the misidentification of the specimen.

It is noteworthy that this is the only occasion when Harmer records a Vachell fish as a type in his catalogue. This may have been the reason why this fish alone was transferred to the British Museum (in 1917). In fact, the specimen is not a type since Richardson described the species solely on the basis of a Reeves illustration (No. β52) and expressly states that he had seen no specimens. It is curious that Harmer lists it as a Vachell fish, but this may be one more case when Richardson overlooked material in Cambridge. Günther (1868, p. 101) considered the species " doubtful ", but presumably it was he who identified the specimen later during one of his visits to Cambridge.

The species has long been known as *Scartelaos viridis* (Ham. Buch., 1822), but Whitley (1929) and Fowler (1962) have pointed to the homonym *Gobius viridis* Otto, 1821. Koumans (1953, p. 263) noted this but continued to use the name *viridis*, apparently unaware that as a junior primary homonym it should be permanently rejected (*International Code*, *Article* 59 (*a*)).

76. " ***Triacanthus biaculeatus*** "
= ***Triacanthus biaculeatus*** (Bloch, 1786)

Two fishes, 35·7 and 118·2 mm. S.L. (the larger fish 149 mm. tot. l.), in good condition, with modern label " *Triacanthus brevirostris* China Vachell " (following the catalogue entry), UMZC. VIII, 209.

Description. (based on the larger of the two fishes). D_1 IV, D_2 22, P i 14, V I, A 18.

In percentages of standard length : body depth 42·5, head length (to upper limit of gill opening) 29·8 ; snout length 19·2, eye diameter 8·0 ; pectoral length 10·3, pelvic length 22·0, 1st dorsal spine length 26·7 ; length of 2nd dorsal fin base 25·5, length of anal base 17·9 ; pre-dorsal distance 42·5, pre-pelvic distance 34·7, pre-anal distance 62·4 ; caudal peduncle, length 22·7, depth (greatest) 12·2, (least) 4·6.

Body depth equal to pre-dorsal distance. Snout slightly concave in profile. Interorbital space slightly concave but with low median ridge. First dorsal spine 9/10 of head length ; second dorsal spine 3/10 length of first spine ; following spines decreasing in length. Distance between the last ray of the first dorsal and the origin of the second dorsal 1·4 times eye diameter. Longest rays of the second dorsal 9/10 eye diameter. Base of second dorsal 1·43 times in base of anal. Pectoral fins rounded, their length $\frac{2}{3}$ of distance between eye and base of first dorsal spine. Pelvic bone between pelvic spines tapering to a point. Caudal forked. Caudal peduncle tapering to base of caudal, its length 4·4 times in standard length, its greatest depth 1·86 times in its length.

Colour: body light brown ; basal part of first dorsal spine, and membrane between first three dorsal spines, speckled with light brown and edge of fin membrane in this area dark brown.

Note: the concave snout profile and the pointed pelvic bone places this specimen in *T. biaculeatus*, not *T. brevirostris* as the label on the jar indicates. The descriptions and key of De Beaufort & Briggs (1962) have been used, but they do not indicate what changes can be expected with age ; the two species are otherwise very similar. Richardson (1846, p. 202) does not list any Vachell material, but the present specimens may have been overlooked.

The final (5th) spine in the first dorsal fin is missing (?concealed) in the larger specimen, a character used by Fraser-Brunner (1941) in his diagnosis of the subgenus *Triacanthus* (*Trixiphichthys*) Fraser-Brunner (type and only species, *Triacanthus weberi* Chaudhuri). The present specimen differs from *T. weberi* in having the normal snout (greatly compressed and pointed in *T. weberi*). Dr. J. Tyler informs us (pers. comm.) that the 5th and 6th spines of the first dorsal may lie below the surface in *Triacanthus* but can be found by staining.

79. " *Tetrodon ocellatus* "

= ***Fugu* (*Torafugu*) *ocellatus*** (Linneaus, 1758)

A single fish, 102 mm. S.L. (127 mm. tot. l.), mounted for exhibition in " perspex " box with modern label " *Tetrodon ocellatus* " but with no indication of locality or donor, UMZC. F.4227 (catalogued without donor or locality).

This fish could have been part of the Cambridge Philosophical Society collection, but Harmer evidently did not consider that it was part of the Vachell collection, nor does Richardson mention Vachell material (see above, p. 147).

In his review of the puffer fish genera, Fraser-Brunner (1943) employed the genus *Torquigener* Whitley, 1930 for this species, which had otherwise been placed in the compendium genus *Sphaeroides*. However, Abe (1952) showed this to be incorrect, and proposed the genus *Fugu* for Japanese members of the genus *Sphaeroides*. Chu, Tchang & Chen (1963) agreed, and we have followed these authors here.

80. " *Echeneis naucrates* "

= ***Echeneis naucrates*** Linnaeus, 1758

One extant fish, 280 mm. tot. l., mounted for exhibition in " perspex " box with modern label " *Echeneis naucrates* ", but with no indication of locality or donor, UMZC. F.2917 (catalogued as China Seas. Cambridge Philosl. Society's Colln.). (A smaller fish, 115 mm. tot. l., *ex* Borneo, is mounted in the same box.)

Richardson mentions a British Museum specimen, but no Cambridge material, even though the present specimen is listed by Harmer as coming from the Cambridge Philosophical Society's collections. The specimen can be regarded as possibly part of the Vachell collection.

TABLE I

Richardson species based on Vachell material

	Richardson species	Name accepted here	Richard. Report Page No.	Reeves illustr. No.	Reeves Page No.
4*	†*Chatoessus maculatus*	*Clupanodon thrissa*	308	109	91
7	*Anguilla clathrata*	*Anguilla japonica*	312	—	—
11	*Bagrus vachellii*	*Pseudobagrus vachellii*	284	—	—
12	*Bagrus limbatus*	*Pelteobagrus fulvidraco*	283	—	—
15	*Solea ovata*	*Microbuglossus ovatus*	279	—	—
16	†*Solea ommatura*	*Zebrias zebra*	279	β13	71
17	*Plagiusa grammica*	*Cynoglossus grammicus*	280	—	—
24	†*Trachinotus melo*	*Psenopsis anomala*	270	97	68
25	*Seserinus vachellii*	*Parastromateus niger*	273	—	—
28	†*Caranx cancroides*	*Caranx (Atule) kalla*	274	β30	35
33	*Ambassis vachellii*	*Ambassis commersonii*	221	—	—
35	†*Serranus shihpan*	*Epinephelus akaara*	231	71	14
36	†*Priacanthus tayenus*	*Priacanthus tayenus*	237	β14	71
53	†*Sebastes vachellii*	*Sebastodes vachellii*	214	69?	14
54	†*Pelor tigrinum*	*Inimicus japonicus*	212	β42	28
60	†*Julis exornatus*	*Halichoeres nigrescens*	258	β10	56
62	†*Gobius platycephalus*	*Glossogobius brunneus*	204	L94	124
64	*Gobius margariturus*	*Rhinogobius margariturus*	205	—	—
65	*Gobius ripilepis*	*Drombus ripilepis*	205	—	—
66	*Gobius stigmothonus*	*Acanthogobius stigmothonus*	205	—	—
67	†*Apocryptes serperaster*	*Apocryptes serperaster*	206	β55	96
77	*Balistes vachellii*	*Abalistes stellatus*	201	—	—

* Number as listed in text.
† Reeves illustration reproduced here.

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INDEX

(modern names for Vachell species given in ***bold face italic***)

PLATE 1

FIG. 1. *Chatoessus maculatus* (=*Clupanodon thrissa*). Reeves p. 91, No. 109.
FIG. 2. *Caranx cancroides* (=*Caranx* (*Atule*) *kalla*). Reeves p. 35, No. β30.
FIG. 3. *Trachinotus melo* (=*Psenopsis anomala*). Reeves p. 68, No. 97.
FIG. 4. *Solea ommatura* (=*Zebrias zebra*). Reeves p. 71, No. β13.

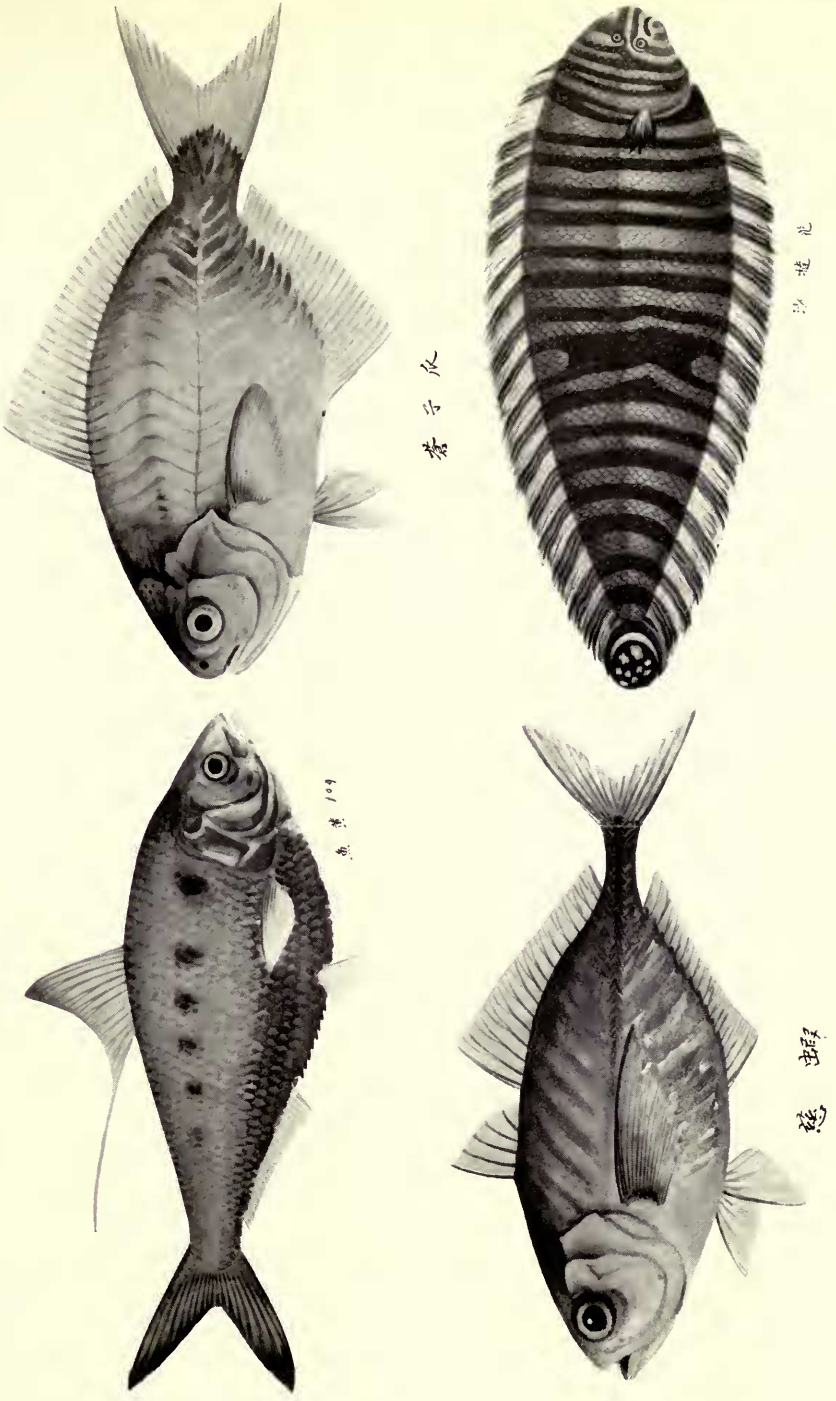

PLATE 2

FIG. 1. *Serranus shihpan* (=*Epinephelus akaara*). Reeves p. 14, No. 71.
FIG. 2. *Priacanthus tayenus* (=*Priacanthus tayenus*). Reeves p. 71, No. β14.
FIG. 3. *Sebastes vachellii* (=*Sebastodes vachellii*). Reeves p. 14, No. 69.

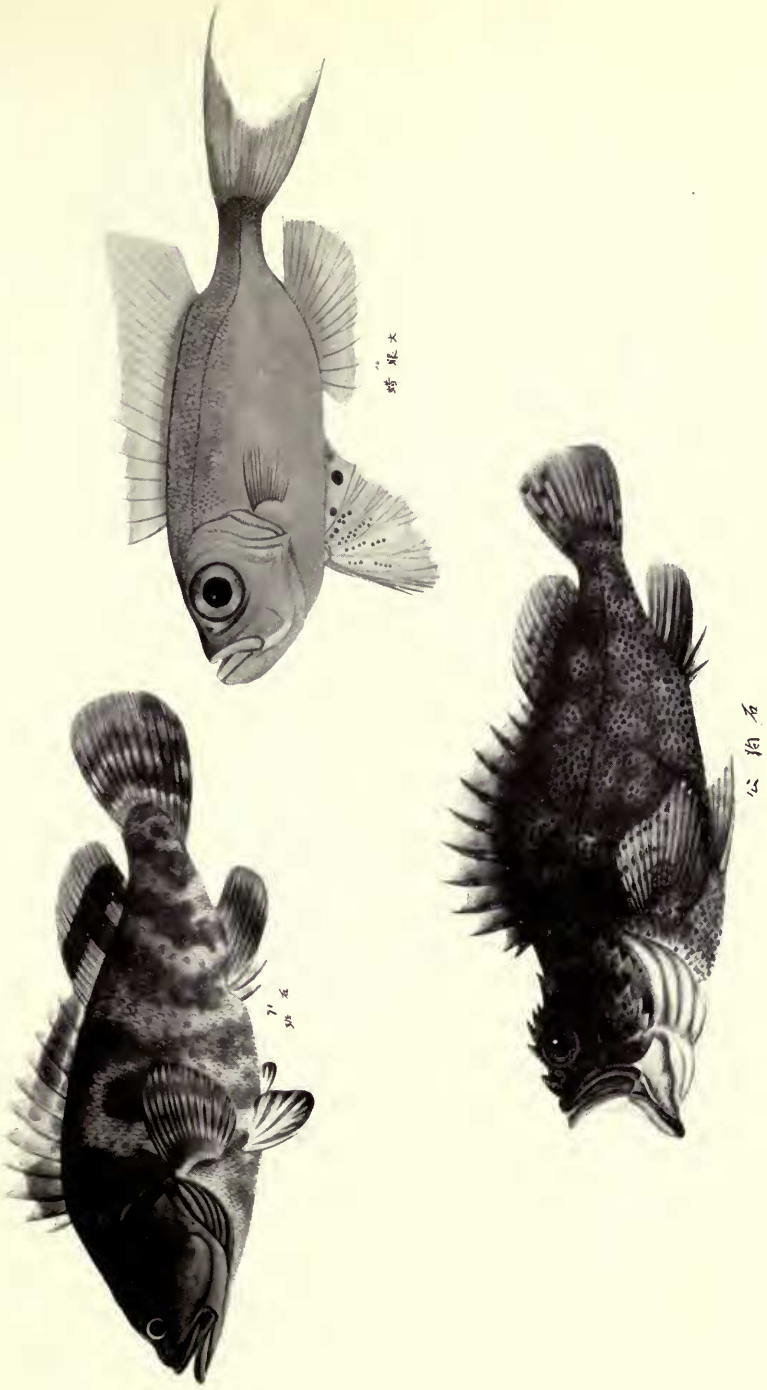

PLATE 3

FIG. 1. *Pelor tigrinum* (=*Inimicus japonicus*). Reeves p. 28, No. β42.
FIG. 2. *Apocryptes serperaster* (=*Apocryptes serperaster*). Reeves p. 96, No. β55.
FIG. 3. *Gobius platycephalus* (=*Glossogobius brunneus*). Reeves p. 124, No. 194.
FIG. 4. *Julis exornatus* (=*Halichoeres nigrescens*). Reeves p. 56, No. β10.